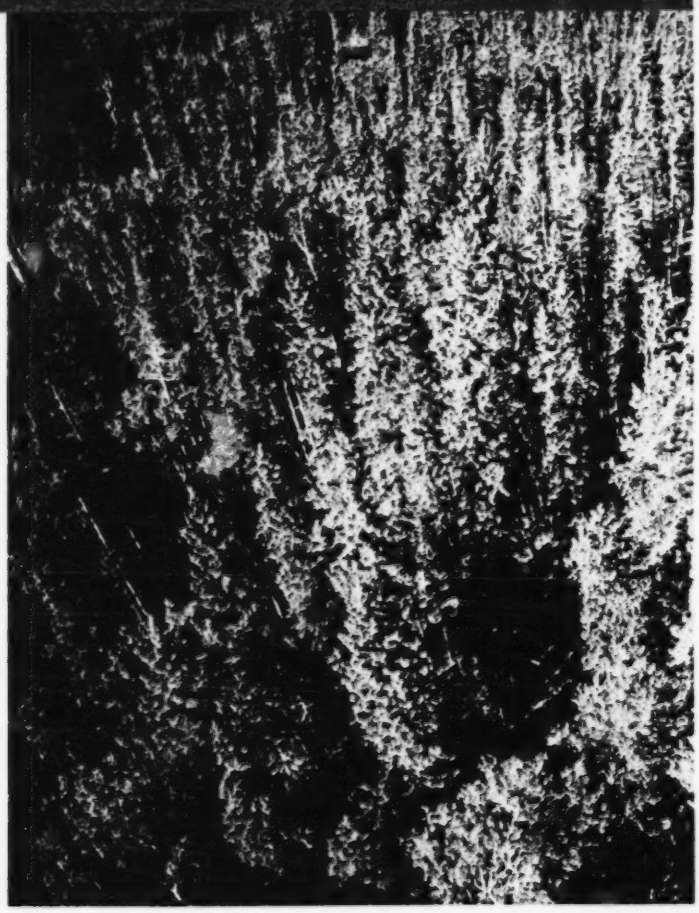
National Forestry Database Program

WOOD SUPPLY IN CANADA

2005 REPORT



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WOOD SUPPLY IN CANADA

2005 REPORT

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

The Canadian Council of Forest Ministers' National Forestry Database Program (NFDP) has a mandate to report on a range of statistics and information relating to forestry activities in Canada, including a national assessment of wood supply. This first national report on wood supply in Canada is based on a reporting framework developed by Timberline Forest Inventory Consultants Ltd. in consultation with the NFDP Technical Subcommittee on Reporting Wood Supply.

The report provides an overview, by jurisdiction, of the wood supply situation in Canada. It includes the history of wood supply estimation and regulation, the current inventory situation, analysis methods, and issues that influence wood supply determinations. The document goes on to report on indicators of Canada's wood supply and concludes with a national roll-up of the indicators.

Canada's wood supply indicators are designed to answer the following three broad questions:

1. What is the current regulated annual allowable cut on provincial Crown forest lands?
2. How closely are regulated harvest levels adhered to on provincial Crown forest lands?
3. What is the future outlook of wood supply on all forested lands in Canada?

Three indicators are applied:

- Current annual allowable cut–defines current regulated harvest levels.
- Harvest control–demonstrates the degree to which harvest regulation is being operationally achieved.
- Projected annual wood supply and growing stock–depicts future trends.

Across the country there is a high degree of consistency in policies, administrative procedures, and technical approaches in the regulation of harvest levels and forecasting of wood supply on provincial lands. However, there is considerable variability in the details of the ways these policies are applied. While implying unanimity would be unwarranted, this report attempts to present a comprehensive overview of these policies and approaches and their applications.

INTRODUCTION

BACKGROUND

The Canadian Council of Forest Ministers' National Forestry Database Program (NFDP) has a mandate to report on a range of statistics and information relating to forestry activities in Canada. This reporting requirement includes a national assessment of wood supply, in the form of an annual compilation of provincial and territorial information in the *Compendium of Canadian Forestry Statistics*.[1] The NFDP Steering Committee established the Technical Subcommittee on Reporting Wood Supply to assist it in fulfilling this requirement.

The Technical Subcommittee developed terms of reference for the design of a national reporting framework for wood supply. The objective was to report on both the current regulatory elements of wood supply and on longer-term trends. Timberline Forest Inventory Consultants Ltd. was engaged to develop this framework in consultation with the provincial and federal agencies. The proposed framework was described in the consultant's report, *Framework for National Reporting on Wood Supply*[2] and adopted by the NFDP at the recommendation of the Technical Subcommittee.

SCOPE OF THE REPORT

This report is a collation of material provided by provincial and territorial forest management agencies and represents a first national report on wood supply in Canada. The first section provides an overview of wood supply in Canada by jurisdiction. It includes a brief history of wood supply and a description of current inventory, analysis, and determination methods, as well as an indication of issues that influence wood supply determinations. This information was provided by government representatives for each jurisdiction. The next section reports on Canada's wood supply indicators: current allowable harvest, harvest control, and projected wood supply and growing stock. The report concludes with a national roll-up of key indicators.

[1] Available at http://nfdp.ccfm.org/compendium/index_e.php

[2] **Timberline Forest Inventory Consultants Ltd. 2002.** *Framework for National Reporting on Wood Supply*. Prepared for Natural Resources Canada, Canadian Forest Service, Ottawa, Ontario.

OVERVIEW OF WOOD SUPPLY IN CANADA

This section provides an overview for Canada and by jurisdiction of the histories, current methodologies, and issues associated with the determination of wood supply in Canada.

NATIONAL PICTURE

Across the country there is a high degree of consistency in policies, administrative procedures, and technical approaches in the regulation of harvest levels and the forecasting of wood supply on provincial lands. However, the details of the ways these policies are applied vary considerably.

Wood supply forecasts also exist for some private, federal, and territorial lands, and management activities on private lands may be encouraged by mechanisms such as taxation incentives. However, no regulation mechanism exists to directly control annual harvest on these lands through legislation (except in British Columbia). Therefore, the concept of the annual allowable cut (AAC)[3] does not generally apply to land tenures other than publicly owned provincial lands (except in British Columbia). To avoid creating a misconception regarding harvest regulation on the other tenures, reporting of AAC in this document is limited as far as possible to provincial (Crown) lands. Exceptions in British Columbia and Prince Edward Island are explained elsewhere in the report. Information on non-regulated wood supply from private lands is included in this report where available.

The following 11 statements represent a common base for description and comparison of wood supply on regulated lands across Canada:

1. AAC regulation is governed by provincial legislation, and at this time applies specifically to publicly owned provincial lands (except in the case of private lands within tree farm and woodlot licences in British Columbia).

2. AAC regulation applies to both area-based and volume-based tenures.

3. AAC levels are reviewed periodically and revised to reflect changes in information and/or practices. Major unforeseen changes can trigger more frequent revision.

4. AAC levels are enforced with the aid of periodic comparisons of AAC and harvest levels. While considerable fluctuation can occur annually, harvest levels may not significantly exceed regulated AAC levels over the regulation period, usually 5 to 10 years.

5. Most provinces establish AAC levels based on a policy of non-declining future wood supply. However, short- and mid-term deviations from this policy can occur to accommodate wood supply constraints associated with transition from old-growth to second-growth sources of supply, or to accommodate short-term timber salvage requirements.

6. Future wood supply is usually evaluated over at least two rotations to capture any impacts associated with the transition to future forest conditions.

7. All jurisdictions are moving to more comprehensive public consultation, on both the establishment of AAC levels and the attendant management planning processes.

8. All jurisdictions employ accepted wood supply forecasting methodologies that capture key aspects of both stand and forest dynamics and management practices. Stand growth and yield forecasts are based largely on empirically derived volume by age relationships, specific to the landbases in question. Definitions of current forest conditions are derived from provincial inventory sources, which in all cases are updated regularly to reflect disturbance changes arising from harvest or natural disturbances, as well as the natural aging of unharvested stands.

[3] The available harvest volume (AHV) in Ontario and the allowable annual cut in British Columbia are analogous to the annual allowable cut (AAC) used in other jurisdictions.

9. Wood supply forecasts and AAC determinations reflect consideration of landbase withdrawals for non-timber values, as well as impacts that multiple-value management strategies may have on harvesting practices within the net harvestable landbase.

10. Wood supply and AAC determinations are net of the non-harvest depletions associated with both endemic and catastrophic events. In the latter case, disturbed areas are assessed to determine their contribution to future wood supply.

11. Wood supply and AAC determinations are based on operational practices that can be currently implemented. The impact of potential new practices is only considered when these practices can be shown to be operationally feasible and their stand-level responses can be reliably predicted.

The map in Figure 1 illustrates the extent and location of the landbase that supports Canada's regulated wood supply. In addition to publicly owned provincial forest lands, the map shows the location of parks and protected areas.

NEWFOUNDLAND AND LABRADOR

Brief History of the Wood Supply Process

The sustainability of the forests of Newfoundland and Labrador has been a subject of concern since the time of the first European settlement. While the early concerns were due to uncontrolled burning, the twentieth-century concern has focused on the ability of the forest to meet industrial needs. Wood supply concerns have led to the formation of two Royal Commissions (1955 and 1981) and one joint federal-provincial Task Force (1973). Due to the lack of reliable inventory data and growth and yield data, the wood supply calculations for these Royal Commissions and the Task Force used a combination of simple area control regulation and volume control formulas (Austrian and Dempster's) to determine harvest levels. In 1984, the province developed its first 20-year forest development plan and initiated a planning cycle by which new plans are generated every five years. In 1989, the first formalized wood supply analysis was undertaken using the FORMAN wood supply model. In 1990 the *Forestry Act* came into effect, and in 2003, the Provincial Sustainable Forest Management Strategy was adopted.

Of the total land area of Newfoundland, 11.1 million ha, approximately 5.2 million ha (46%) is forested. Approximately 69% of productive timber land on the island has been tenured to the province's two pulp and paper companies, with a mixture of freehold, leased, and licensed land. The total area of Labrador is approximately 29 million ha, including 18 million ha of productive forested land.

Current Process and Information Used for Estimating Wood Supply

In 2001, the Newfoundland and Labrador Department of Natural Resources completed its latest intensive wood supply analysis, using the best data available and the latest advances in wood supply modelling software and techniques. This process is complicated and involves numerous inputs. Some of the more crucial are described below.

Updated Inventory Information
This includes all the latest cutover information, any large disturbances (fire, insects, and blow-down), all silvicultural activities (planting and thinning), and new stand typing information collected since the last wood supply analysis.

Landbase Review
A detailed review of all productive forest lands is undertaken by each District Manager. Areas deemed harvestable are identified as Class 1. Areas such as parks, reserves, water buffers, steep slopes, or any other areas with regulatory or operational restrictions are designated Class III lands and are not used to calculate the AAC. Class III lands are, however, used to meet non-timber objectives such as the retention of old forests and wildlife habitat. This review is the basis for the wood supply analysis.

Yield Curve Development
All growth information from various inventory plots is reviewed and a prediction is made as to how fast stands will grow and how much volume

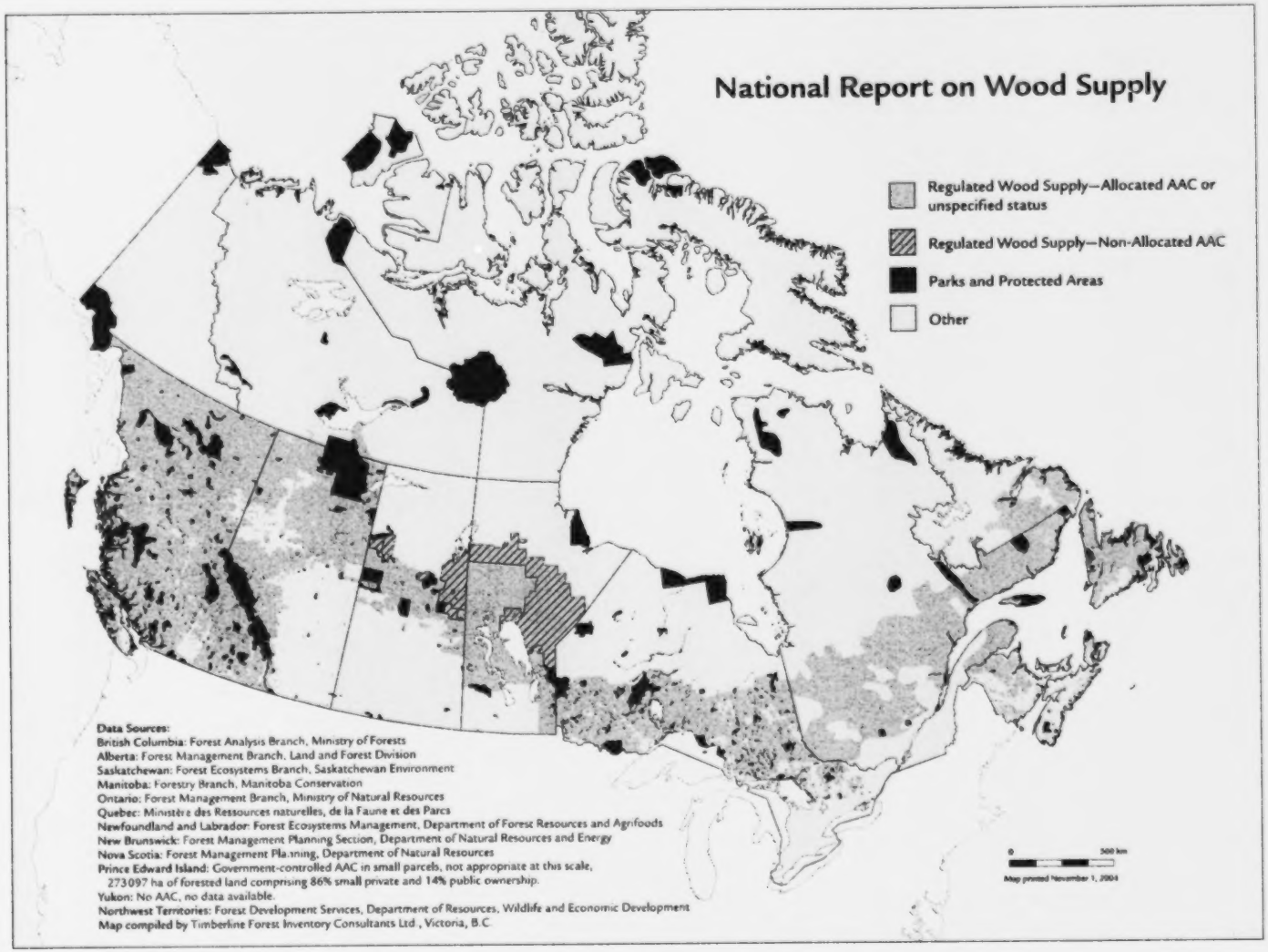
National Report on Wood Supply
Regulated Wood Supply—Allocated AAC or unspecified status
Regulated Wood Supply—Non-Allocated AAC
Parks and Protected Areas
Other
Data Sources:
British Columbia: Forest Analysis Branch, Ministry of Forests
Alberta: Forest Management Branch, Land and Forest Division
Saskatchewan: Forest Ecosystems Branch, Saskatchewan Environment
Manitoba: Forestry Branch, Manitoba Conservation
Ontario: Forest Management Branch, Ministry of Natural Resources
Quebec: Ministère des Ressources naturelles, de la Faune et des Parcs
Newfoundland and Labrador: Forest Ecosystems Management, Department of Forest Resources and Agrifoods
New Brunswick: Forest Management Planning Section, Department of Natural Resources and Energy
Nova Scotia: Forest Management Planning, Department of Natural Resources
Prince Edward Island: Government-controlled AAC in small parcels, not appropriate at this scale,
273097 ha of forested land comprising 86% small private and 14% public ownership.
Yukon: No AAC, no data available.
Northwest Territories: Forest Development Services, Department of Resources, Wildlife and Economic Development
Map compiled by Timberline Forest Inventory Consultants Ltd., Victoria, B.C.
0
500 km
Map printed November 1, 2004

Figure 1. Regulated wood supply in Canada.

they will produce. The resulting information is fed into various growth and yield models, which produce a yield curve for each commercial species on various site types (good, medium, and poor). Measurements are then taken in the field to verify the yield curves.

Regeneration Updates and Assumptions
For the timber supply analysis, assumptions must be made regarding how fast areas respond after harvesting and what types of species will dominate the future forest. Different areas of the province respond differently and a set of base rules must be determined. In making the determination, the Department of Natural Resources draws on past practices and the experience of the district managers.

Consumption Analysis
An important part of the analysis is an examination of the demand for wood within the province. Forests are delineated and classified to verify the amount of wood being consumed by the public, pulp and paper companies, and sawmill industries. This tracking of wood is complex and requires careful implementation.

Computer Modelling and Spatial Analysis
Once the inputs and assumptions are verified, the information is input to the Woodstock™ wood supply model, which calculates the optimal AAC for each district by owner. A number of runs are performed to determine the sensitivity of various inputs. Spatial harvest schedules are then completed using the Stanley™ model.

Gross Merchantable Volume Deductions
The final step in the process is to apply deductions to the calculated AAC; these represent volume depletions outside of normal harvesting practices. Volume loss results from fires, insect infestations, and timber utilization. A prediction is made as to how much volume will be lost annually due to these factors over the next five-year period. Empirical evidence forms the basis for this prediction.

Issues and Conflicts That Influence Wood Supply Determination

Currently, work is under way to collect and compile data that will be used to develop new AACs in 2006. The following are a few of the major issues to be addressed in the 2006 analysis:

- Refinement of non-timber objectives used in the wood supply analysis. Ideally, an attempt will be made to look at the spatial arrangement of mature forests and wildlife habitat across the forested landscape.
- Better age and stand health estimates for mature and over-mature stand types. The better age and health data will allow more accurate harvesting scheduling and the mapping of mature forest types and wildlife habitat.
- Development of first-generation hardwood yield curves and the incorporation of hardwood AACs into the wood supply analysis will occur for the first time.
- A complete review of availability of all stand types to support timber and non-timber objectives.

Interpretations of Wood Supply Estimates and Limitations of Use

The Forestry Services Branch of the Department of Natural Resources undertakes the wood supply analysis for all timber ownerships in the province, thus ensuring a standard approach across the province and across the different ownerships.

While the wood supply on the island follows the standard modelling approach used across Canada, wood supply projections in Labrador are still based on simple area control analysis due to the lack of growth and yield information and inventory data. As a result, fewer detailed forestry statistics are generated for Labrador. However, work is under way to initiate formal wood supply modelling in Labrador.

The only private land used in the calculation of the AACs is a small area of industrial freehold; all other private land has been excluded from the analysis. Provincial Crown land accounts for more than 95% of the land area of the province and for more than 99% of the area used in the determination of provincial AAC.

To date there has been no formal modelling of hardwood AACs. Hardwoods have, in the past, been mainly used for fuel wood consumption by residents. However, with the increasing demand for industrial use of hardwoods, formal hardwood AACs will be established in 2006.

PRINCE EDWARD ISLAND

Brief History of the Wood Supply Process

When the island that became Prince Edward Island (P.E.I.) was taken from the French as a spoil of war, it was surveyed into 67 townships of about 20 000 acres (8097 ha) each. These townships (known today as lots) were given away in a lottery in 1767 to individuals who were owed money by the British Crown. At that time the whole province became private land with the exception of the three settlements (Royalties) of Charlottetown, Georgetown, and Princetown. These Royalties were granted as town or pasture lots over the next hundred years. The provincial land owned by the government today was purchased back from private owners.

The first recorded pronouncement on wood supply for the province was made on 14 April 1821:

> The Timber Trade, however, as its sources are nearly exhausted, is now nearly over, and necessity will, in some measure, compel the husbandman to allot his time and attention to the cultivation of the soil.[4]

Similar comments were made again in 1855 and 1895, indicating that supply had not improved in the ensuing decades.

The first wood supply analysis, based on forest inventory information, was undertaken between 1984 and 1986, when the Department of Energy and Forestry carried out a preliminary examination of sustainable round wood and biomass harvest levels. These efforts used the WSM5 wood supply model, the 1980–82 forest biomass inventory, and preliminary yield curves constructed from the 1980 inventory temporary sample plots. In 1986 and 1987 the Department acquired the FORMAN wood supply model and produced wood supply estimates for round wood and biomass. The results of this work were published as part of the *P.E.I. Twenty-Year Forest Development Plan*.[5]

FORMAN was also used as the wood supply model for the estimates produced for the 1990 *State of the Forest Report* published in 1992. These results were based on the 1990–92 Forest Biomass Inventory and improved yield curves that utilized both temporary and permanent sample plots. Subsequent updates in 1995 and 1998 were based on 1994 and 1997 depletion studies and utilized the same methodology as the 1990 estimates. The 2000 analysis used the 2000 Corporate Land Use Inventory, the Woodstock™ wood supply model, and yield curves that had been further strengthened by increased permanent and temporary sample plot data.

The forest area of the province in 1990 was 279 193 ha, or 48.5% of the provincial area. In 2000 it was 263 207 ha, or 45.7% of the provincial area. The standing total volume in 1990 was 31.8 million m^3; in 2000 it was 24.2 million m^3.

Current Process and Information Used for Estimating Wood Supply

The wood supply model is run whenever there is a major change in inputs such as a new inventory or a major alteration in industry utilization. At that time the following inputs are made into the wood supply estimation system:

> Areas protected from harvest by legislation are removed since they will not be included in the modelling process (i.e., national parks, protected natural areas).
>
> Current inventory data are classified into forest types. Each forest type follows a separate volume over age curve (e.g., tolerant

[4] ***Prince Edward Island Gazette***, Saturday 14 April 1821.

[5] **Dendron Resource Surveys Ltd. 1987.** *P.E.I. Twenty-Year Forest Development Plan*. Department of Energy and Forestry, Charlottetown, PEI. 56 p + 38 appendices.

hardwood and red pine plantations have very different curves).

- The area in each age class is determined from the inventory data and 15% of each age class of each forest type is removed due to private owners' restrictions on harvesting.
- The responses to various treatments are determined from comparison with previous inventories and surveys (e.g., harvest of a black spruce type results in 70% regenerating to black spruce and 30% regenerating to white birch or poplar; thinning of the same stand would result in 100% moving into a thinned black spruce type).
- Yield curves for each forest type are constructed from measurements of permanent sample plots, temporary sample plots, and other studies.
- Harvest levels are determined from statistics collected from a number of sources, including mill gate receipts and fuel-wood consumption surveys.

The wood supply model Woodstock™ is run utilizing the inputs previously noted; this reflects harvest rules (maximize sawlog production) and treatment levels (planting and thinning levels are set based on the resources available). Model control is based on balancing age class distribution and maintaining growing stock.

Since 87% of the forest land in the province is private land, when referring to provincial values the term sustainable harvest is preferred over annual allowable cut (AAC). AAC figures have been produced for government-owned land, but sustainable harvest figures are generated for the province.

Sustainable harvest levels are determined every 10 years, as required by legislation. There are no plans at this time to change the current approach.

Issues and Conflicts That Influence Wood Supply Determination

The following policy and technical issues influence wood supply determination:

- Shrinking forest landbase (primarily private forest land conversions to other land uses).
- The plans of private landowners for their woodlots and the availability of the forest for harvest (a continuously changing variable, 15% non-availability on private woodlots based on survey in 2001).
- Environmental stream buffer limitations.
- Older stands are not necessarily planned and harvested before younger stands.
- AAC is not calculated in P.E.I. The Department calculates sustainable yield for all ownerships included for various products (i.e., softwood sawlogs and hardwood fuel wood).
- Age class structure is not balanced, as there is a lack of age classes under 30 years of age and very little over 80.

Interpretations of Wood Supply Estimates and Limitations of Use

In P.E.I, 87% of the forest is privately owned, with an average woodlot size of 16 ha. There is no industrial freehold. Wood supply can vary quickly with changes in woodlot owners' attitudes towards harvest.

NOVA SCOTIA

Brief History of the Wood Supply Process

Wood supply modelling began in Nova Scotia in the 1970s with the development of the SAWS (Strategic Analysis of Wood Supply) model by the Department of Natural Resources. Initially, wood supply analysis was used to measure the long-term effects of the spruce budworm infestation on future harvest levels. In the late 1970s and the 1980s, the SAWS model determined silviculture programs and funding levels in order to increase sustainable harvest levels, which were depressed by the spruce budworm outbreak. Wood supply analysis was also used to establish AAC levels on provincial Crown lands. In addition, the analysis provided forest management scenarios to assist in the development of provincial strategic-level plans throughout these years and into the 1990s.

The latest wood supply forecast, completed in 2000, provided the basis for regulating silviculture requirements on private forest land in Nova Scotia to achieve long-term sustainable growth targets. Silviculture requirements on private lands became law in Nova Scotia in 2000 with the enactment of a revised *Forests Act* and the implementation of the Forest Sustainability Regulation. The regulation required silviculture to be conducted to an equivalent value of $3.00 per cubic metre of softwood and $0.60 per cubic metre of hardwood harvested from small private and industrial forest lands.

Current Process and Information Used for Estimating Wood Supply

Nova Scotia's current process uses the SAWS simulation model to forecast potential wood supply for a period of 80 years. The analysis is conducted by the Forestry Division, Department of Natural Resources, and subjected to an external review of process and results prior to public release. Analysis with SAWS involves a simulation of current forest conditions, management activity, forest policies, regulations, factors affecting growth, impacts from non-forestry values, and landowner behaviour into the future. The analysis is conducted for all forest land tenures by forest cover type on a regional basis.

The sustainable wood supply potential is modelled for the forest lands that are determined to be available for timber-based harvests. In Nova Scotia, the latest analysis has calculated that approximately 62% of the forest land is available for timber harvest. Growth of Nova Scotia's forest types has been modelled according to results from an extensive network of permanent sample plots (PSPs) for natural and managed stand conditions that have been in place for over 30 years. This network of PSPs includes 3200 random plots throughout Nova Scotia managed by the inventory section and approximately 1000 plots of targeted management treatments maintained by the planning section of the Department.

The SAWS modelling procedure provides strategic-level, non-spatial wood supply forecasts for all tenures but these forecasts are not considered AAC levels. The sustainable wood supply results reported for Nova Scotia Crown lands are strategic-level AACs, from which land managers determine operational AACs.

The current schedule of wood supply analysis is conducted on a five-year cycle. The analysis process currently under way, and scheduled for completion in 2005, is similar to the previous process using SAWS, but with a revised and upgraded version of the model.

Issues and Conflicts That Influence Wood Supply Determination

A key issue in the most recent analysis was the threat of a non-sustainable harvest from the small private woodlot forest sector in Nova Scotia. A sustainable wood supply potential for that landbase was achieved through forest sustainability regulations that required silviculture adequate to meeting the current harvest demand.

Interpretations of Wood Supply Estimates and Limitations of Use

The Nova Scotia process provides a forecast of potential forest growth on all tenures for a period of 80 years, based on current knowledge of forest condition, management and activity, and restrictions for other values and interests. It is a non-spatial strategic-level process, not intended for the purpose of establishing AAC levels by tenure.

The analysis process and results are used primarily to assess and set silviculture requirement levels in the Forest Sustainability Regulation and to provide a provincial-level assessment and report on the current state and future forecast of wood supply sustainability of Nova Scotia's forests. The process also coincides with, and provides input for, the development of the Department's five-year forest strategy policy document, scheduled for release in 2006.

The results of the Nova Scotia wood supply analysis are not intended to set harvest limits on Crown lands or any other land tenure. The analysis does not take into account spatial, operational, and economic constraints, and therefore it is not adequate for setting operational harvest or AAC levels. In Nova Scotia the major industrial landowners

conduct their own operational wood supply analysis. Nova Scotia Crown lands, through licence holders and the integrated resource management planning process, are now using the Woodstock™ modelling system to develop future long-range management plans and AAC targets.

NEW BRUNSWICK

Brief History of the Wood Supply Process

New Brunswick's history of forest use dates back to the earliest days of European settlement. From the seventeenth century onward, the sawmill industry (and later the pulp and paper industry) flourished and continued to expand, but it was only in the 1930s that a requirement was made that the annual harvest not exceed the rate of growth.

In 1974, the *Forest Resources Study*[6] recognized an impending shortage of primary softwood species and identified an immediate need for the management of provincial forests.

That study eventually led to the 1980 *Crown Lands and Forests Act*, which provided for the division of the provincial Crown forest into 10 timber licences. Each licence was assigned to one of the 10 larger indigenous forest-based companies in the province, in return for which each company assumed specific obligations under the act.

These obligations include the requirement that licensees develop and periodically revise a management plan that establishes sustainable wood volumes over an 80-year horizon and maps harvest and silviculture operations for 25 years. The first management plan was created in 1982 and has been revised every five years since. The 1982 plan was basic in design and focused exclusively on determining a sustainable harvest level, including an overall landbase reduction to account for buffers, primarily on watercourses. The 1987 management plan used a new inventory, improved the accounting of buffers, and included some deer wintering areas. In the 1992 revision, specific multiple-use objectives were included for the first time. The 1997 plan introduced a biodiversity objective, which was refined in 2002, at which time protected natural areas were incorporated into the management plans.

The total area of the province is 7.2 million ha, of which 49% is Crown (including 2% federal) and 51% is privately owned. The total AAC for the province is approximately 11 million m^3, of which 5.4 million m^3 are from Crown land.

Current Process and Information Used for Estimating Wood Supply

The following key elements form the basis of New Brunswick's wood supply analysis.

At the core of the wood supply analysis is the New Brunswick forest inventory. This inventory, which is GIS (geographic information system) based, is revised (re-interpreted using aerial photography) on a 10-year continuous cycle by the Department of Natural Resources and Energy. It is also updated annually with information on cuts, burns, and silviculture on Crown land. For the management plan, the inventory is summarized into strata of similar forest condition and age.

Yield curves are then developed for each of the strata. A model has been developed (STAMAN) that designs yield curves based on field data, including permanent and temporary sample plots and fifth-year surveys of plantations and spacings. The New Brunswick Growth and Yield Unit uses this model to develop yield curves for all existing stand conditions (natural and managed) and for conditions occurring after harvesting (i.e., future natural regeneration, plantations, and spacing).

A transition matrix, which is a schedule of post-harvest response, is also developed; it predicts which strata will be created after harvesting.

These components (strata, yield curves, and transition matrix) are used as input to the Woodstock™ forest-level timber supply model, which allows determination of sustainable timber supplies and wildlife habitat requirements using silvicultural inputs, and various harvest types (both

[6] **Forest Resources Study. 1974.** *Report of the Forest Resources Study*. Government of New Brunswick, Fredericton, NB. 362 p.

clearcut and non-clearcut) while respecting required non-timber objectives. Once a harvest level has been determined, it must be mapped for 25 years to ensure that the volumes predicted are operationally available.

The next calculation will be done in 2007.

Issues and Conflicts That Influence Wood Supply Determination

The 2002 management plan for Crown land in New Brunswick focused on both timber and non-timber resources, including the following issues.

Timber

There is a government requirement to model the forest on each licence to determine the non-declining harvest rate that the forest can sustain over an 80-year planning horizon. Silvicultural inputs must be factored in and other non-timber objectives must be met (see below). This sustainable wood supply, or AAC, is then allocated to wood users on the licence, and the actual volume of wood harvested must be within 1% of the AAC at the end of the five-year period. To access this AAC, annual operating plans are prepared, derived from the management plan.

The current AAC from New Brunswick Crown land is fully allocated.

Old Spruce – Fir Habitat

Given the age class structure of the inventory, harvesting usually targets older softwood stands to capture mortality. Studies by wildlife biologists have indicated that this strategy would adversely affect those wildlife species that prefer older softwood habitat types. Objectives have therefore been developed to maintain a sustainable supply of a specific level of old spruce-fir habitat (OSFH) for each licence.

Deer Wintering Areas

Improving habitat for white-tailed deer was deemed an important requirement of forest management planning in New Brunswick. Consequently, all known deer yards were identified and deer wintering areas (DWAs) were created that contain the original deer yard as their nucleus. Any harvesting that improves the long-term habitat for deer is permitted in the DWAs.

Buffers

To protect water quality and enhance fish and wildlife habitat, management plans require the design of buffers on all watercourses that are 0.5 m and wider. The buffer widths required vary by licence and size of the watercourse. Limited harvesting is permitted in the buffer providing the stability of the buffer is not compromised.

Protected Areas

Protected natural areas have been identified to preserve representative areas of the New Brunswick landscape; they comprise approximately 140 000 ha.

Biodiversity

New Brunswick has established vegetation community objectives for each Crown licence that are equivalent to 12% of the total area in each community type, as defined by the 1982 forest inventory and adjusted for human disturbance.

Interpretation of Wood Supply Estimates and Limitations of Use

All of the foregoing discussion has focused exclusively on Crown land wood supply. Crown land comprises about half of the total provincial landbase, with the remainder about evenly split between small freehold and large industrial freehold.

Small freehold properties (i.e., private woodlots) are organized under seven marketing board areas within the province and each is currently undergoing a revised wood supply analysis. Other than a requirement to maintain buffers around watercourses, there are no government regulations controlling the rate of harvest on private woodlots. However, there is general agreement that private woodlots are currently over-harvested.

Large industrial freehold owners independently determine their sustainable AACs using silvicultural inputs and they include management for some non-timber objectives.

QUEBEC

Brief History of the Wood Supply Process

In 1972, the Quebec government adopted its first forestry policy, and the *Lands and Forests Act* was amended to cancel forest concessions dating back to the late 1800s and early 1900s. The amendment to the act also aimed to provide better guidelines for the development of the forest industry, and improve the use of the resource. Concessions had proved to be an obsolete form of management, and a cause of the under-utilization of forest resources. Allowable cut was only partially used; not all species were harvested and technological changes had made it possible to use wood chips instead of round wood.

The high demand for wood from Crown forests created by a developing softwood lumber industry, and successive spruce budworm epidemics in the 1970s and 1980s, had led to concerns about a shortage of forest resources in Quebec. The concerns, the need to review forest tenure methods, and the desire to adapt forest management to the changing needs of society culminated in a full review of the forestry system and passage of the *Forest Act* in December 1986.

Determining annual allowable harvests in Crown forests, or calculating allowable cut, thus became the cornerstone of the new forest system, and from that point on, yield from Quebec Crown forests had to be sustainable.

In 1986, allowable cut in Quebec Crown forests was 38.8 million m^3. The first sustainable allowable cut was calculated in 1989; it was estimated at 42.4 million m^3. It was recalculated in 1994 and the result was 40.7 million m^3. Because of an increase in forested area, Quebec's allowable cut reached 43.7 million m^3 in 1999. Sustainable allowable cut in Quebec's Crown forests will be reassessed in 2008.

Current Process and Information Used for Estimating Wood Supply

The annual sustainable allowable cut is the maximum volume of wood, by species or species group, that can be harvested annually, in perpetuity, from a given forest area, without decreasing the productive capacity of the forest environment.

The annual yield is the annual sustainable allowable cut by species or species group, expressed on the basis of what may be harvested, on average, per hectare in an area intended for forest production. This takes into account the distribution of stands by age classes in the forest area, the silvicultural systems that may apply, and the biophysical characteristics of the area (such as drainage class and type of surface deposit).

If the forest area contains high-quality hardwood or softwood species, the annual yield is determined by taking into account silvicultural systems that will not only maintain yield volume, but also increase the quality of the wood produced.

Calculation of the allowable cut is based on the land area where forest production is permitted (or is a priority) within a common area. The calculation is also based on the method and the assumptions described in the Forest Management Manual, as required by the *Forest Act*.

Allowable cut is calculated by means of a simulation model (SYLVA II) developed by the Ministère des Ressources Naturelles, de la Faune et des Parcs (Quebec department of natural resources, wildlife and parks) in co-operation with the partners involved. This model makes it possible to simulate forest growth taking into consideration the biophysical characteristics of forest areas, the composition of each stand in the area, and the anticipated effects of the chosen management strategy.

The main functions of the SYLVA II model are the following:

- selection of the reference area;
- description of the existing forest and its growth over time;
- definition of the management strategy;
- simulation; and
- simulation results.

The selection of the reference area makes it possible, based on the perimeter of the common area, to list the forest stands in the area with their

respective surface areas, to extract eco-forestry data on the area from the database, and to divide the simulation area into sub-areas in order to allow for wildlife, recreation, accessibility, or other considerations. This step makes use of such factors as the results of analyses of the socio-economic environment (controlled harvesting zones, outfitters, resorts, etc.).

A description of the existing forest is established for each group of stands, based on age, present volume, a simulation of growth over time, natural regeneration over time, and characteristics such as vulnerability to spruce budworm and quality of habitats for certain wildlife species. Several sources of information are required to accurately describe the current forest and to project its growth over time: eco-forestry inventories, yield tables, and growth rates from studies of permanent inventory plots, as well as results of forest-monitoring analyses.

The management strategy involves silvicultural and harvesting scenarios. The natural growth of the forest is simulated. Each of the activities in the management strategy is quantified, for a given moment, in terms of an anticipated effect (change in growth or species composition) based on performance priorities (spatial location or scheduling) and predetermined limits (in volume or surface area). Management strategy accounts for allocations, natural disturbances, wildlife sanctuaries, patches of old forests, sensitive viewsheds, block cutting, buffer strips, uncut strips, etc.

The model guarantees that management strategy activities are simulated according to the order and the limits set out in each scenario. Forest growth is projected over 150 years, based on the effects of the chosen management strategy on all the forest areas in the management unit.

The simulation results are presented for 30 five-year periods. For each of these periods, harvest volumes are given by species or group of species, and areas to be covered by each type of silvicultural system are specified. The analysis confirms whether the production, protection, and development objectives set out in the management strategy were achieved and identifies any changes to be made. The simulation results are saved by the model so they are available for future use by other computer programs (spatial reference systems, databases, report generators, etc.).

Issues and Conflicts That Influence Wood Supply Determination

A number of factors directly influence the calculation of allowable cut and consequently its result:

- Quality of forest information (capacity, yield tables, etc.).
- Size of management unit (usually the greater the surface area, the greater the allowable cut per unit area, because the chances of an irregular forest are smaller).
- Lengths of rotation and calculation horizon (the longer the periods, the smaller the annual available volume and the greater the chances of stock shortage problems).
- Silvicultural systems (these can increase yield if they are included in the calculation and if they are effectively implemented).
- Operational constraints (if the forest that is the focus of the calculation cannot, in practice, be completely harvested, the result will be overestimated).
- Recovery of waste wood (this often results in a temporary increase in harvest or allowable cut, because it will be followed by a major decrease in standing volume or productive forest area).
- Other resources (the versatility of the area as well as conservation policies reduce harvestable surface area and volume).

Interpretations of Wood Supply Estimates and Limitations of Use

The SYLVA simulation model, used for official calculations of allowable cut in Quebec Crown forests, is primarily a planning tool that allows the user to simulate, compile, and illustrate different forest management scenarios. SYLVA mainly draws comparisons between various scenarios and offers choices of forest management opportunities.

The method and assumptions used to calculate allowable cuts in Quebec Crown forests are found in the Forest Management Manual of the Ministère des Ressources Naturelles, de la Faune et des Parcs. To ensure that assumptions relating to the natural evolution of forests and particularly the expected effects of the various silvicultural systems are as valid as possible, the manual sets out broader parameters to be applied by the systems in the various stands and establishes the principles to follow in identifying the true impact of the systems.

ONTARIO

Brief History of the Wood Supply Process

The earliest strategies to secure wood supply involved reserving Crown land forests (such as the Broad Arrow policy of reserving forests for the Royal Navy in 1763). Regulations to prevent over-harvesting first appeared in the *Crown Timber Act* of 1849. The *Crown Timber Act* of 1952 established the principles of sustained yield and the designation of management units. From 1952 to 1979, allowable cuts were calculated as part of the inventory procedure. Since 1979, under a revision to the *Crown Timber Act*, the allowable cut (under various names) has been determined as part of forest management planning.

Forest management is currently carried out in accordance with the *Crown Forest Sustainability Act* (CFSA, 1994). The limit for harvesting is determined according to the *Forest Management Planning Manual for Ontario's Crown Forests*, regulated under the CFSA.

Ontario has regulated harvest on Crown lands, using various forms of area regulation, since 1980. From 1985 to 1997, harvest was limited by the maximum allowable depletion (MAD), a limit that also reflected non-harvest depletions. Since 1998, harvest area is limited by the available harvest area (AHA). The AHA applies to the term of the plan (usually five years). For the available harvest area, there is a corresponding available harvest volume (AHV), which, when expressed on an annual basis, is analogous to the AAC used in other jurisdictions. Further, although AHA is expressed as harvest area, the analysis supporting the available harvest area includes projections of harvest volume as well.

Historically, the responsibility for preparing forest management plans, including the determination of harvest levels, has been passed back and forth between the Crown and the forest industry. Currently, forest management plans are prepared by multidisciplinary planning teams that are usually led by the industry and include government and industry staff as well as a local citizens' committee representative. Forest management plans must be approved by the local Regional Director of the Ministry of Natural Resources.

Current Process and Information Used for Estimating Wood Supply

For Crown forests, the available harvest area and volume are determined through forest management planning. In private forests, harvest is largely unregulated, although approximately 10% of Ontario's private forests are managed according to a plan; this is encouraged with tax incentives. Although the harvest is not regulated, the province is aware of harvesting because mills are required to report the volume of wood originating from private lands.

The *Forest Information Manual* (a manual regulated under the CFSA) defines inventory standards. Under the CFSA, companies are required to provide an inventory of forest resources on lands under licence to them. There is currently no requirement to carry out sampling in the development of yield curves. Yield assumptions are usually based on the existing provincial normal yield tables or more recent yield research.

Forest management plans are prepared for the 48 management units in the Area of the Undertaking (the portion of Ontario whose Crown forests are managed for commercial timber production). Forest management plan production and renewal is currently on a staggered five-year schedule.

The process to determine the AHA and analysis requirements is specified in the *Forest Management Planning Manual* and the *Forest Information Manual*.

Additional direction is provided by forest policies and management guides.

In a forest management plan, objectives are developed for desired benefits or outcomes that can be achieved by managing forest cover. The planning team and local citizens' committee determine these benefits or outcomes. They may be economic, such as a continuous and predictable supply of suitable wood, or social and environmental, such as the conservation of old-growth white pine. The planning team develops a sustainable management strategy to meet all objectives through a process that involves analysis of various combinations of benefit levels and management approaches. These combinations are evaluated and a sustainable management strategy is selected to guide the planning of forest operations.

All current plans use the Strategic Forest Management Model (SFMM) for the analysis of management strategies. SFMM, developed in Ontario, is a linear-programming-based optimization model. It is similar to many other models in its representation of clearcut and shelterwood management. For selection management, however, SFMM uses basal area classes rather than age classes to define the forest. Similarly, silvicultural options for selection relate to improving forest conditions, improvement being expressed as an increase in the ratio of acceptable to unacceptable growing stock (acceptable growing stock improves in timber quality if left to grow; unacceptable growing stock is not expected to improve).

The models used for analysis in Ontario must project various types of information through time, including forest condition, forest dynamics, areas treated, finances, wood supply, potential wildlife habitat, and forest diversity. Analysis usually starts by focusing on non-spatial aspects of objectives and sustainability. Spatial management strategies are included in the analysis as much as possible; for example, harvest is often deferred in areas required for future marten core habitat.

Analysis must represent natural disturbances and forest transitions. Transition assumptions are represented as a proportion of a forest class that succeeds a different forest type. Disturbance assumptions reflect expected stand-replacing disturbances, mainly fires. Assumptions are based largely on professional interpretation of ecological process and are represented deterministically in forest models.

The *Forest Management Planning Manual* has recently been revised; the first forest management plans to incorporate all the new requirements will come into effect in 2007. The proposed *Landscape Guide* will update and consolidate direction regarding the forest landscape contained in existing guides, including standards and guidelines related to disturbance patterns, marten habitat, and caribou habitat.

Issues and Conflicts That Influence Wood Supply Determination

Ontario aims to have a complete ecological representation in its parks and protected areas. The establishment of new protected areas under Ontario's Living Legacy (1999) is a big step towards completing this representation in parks and protected areas. In the future, permanent increases in wood supplies will be shared between new industrial use and new protected areas.

The Ontario Forest Accord (1999) and the subsequent "Room to Grow" (2002) policy framework linked the expansion of parks and protected areas to the protection of wood supply for industry. Consequently, groups that had traditionally been in contention in the so-called "war in the woods" would now aim for a shared goal—room to grow for parks to protect Ontario's ecological integrity, and room to grow for industry to protect jobs and forestry's contribution to the provincial economy. The accord also promises that there will be no net increase in delivered wood costs and no long-term reduction in wood supply as a result of new parks and protected areas.

Ontario is consolidating direction contained in the existing 34 forest management guides into a system based on the level to which the direction applies, from the landscape level through to the site level. The consolidation will also address issues related to conflicting and ambiguous direction in the current set of guides.

Utilization of the available harvest area has increased during the last decade. The increase can

be attributed to industrial utilization of small wood and hardwoods, as well as a decrease in supply due to the old forest profile (an abundance of mature and old forest areas) and increased planning requirements. The gap between the allowable harvest and the actual harvest is closing, leaving less room for operational flexibility.

As more and more management objectives are being expressed in terms of spatial forest conditions, there is pressure to explore different ways of achieving these objectives. The focus is not just on the size distribution of the cutblocks and disturbances; consideration must also be given to the spatial arrangement of established forest type; for example, to provide marten habitat. It is anticipated that spatially explicit models will assist in addressing these challenges.

Because many objectives and measures of sustainability relate to forest conditions, analysis needs to accurately predict both forest conditions and wood supply. This requirement is a technical challenge, particularly with respect to the representation of random events (such as fire and transition) in spatially explicit models.

Interpretations of Wood Supply Estimates and Limitations of Use

All wood supply estimates apply to Ontario's Area of the Undertaking; that is, the portion of Ontario's Crown land managed for timber production. This area excludes most of Southern Ontario as well as the northernmost Crown forests. Ontario has no projections of wood supply from private land, including forest land owned and managed by the forest industry; however, between 10 and 20% of its supply actually does come from private lands. Ontario's forest industry obtains less than 5% of its wood supply from outside Ontario, primarily from the United States, Manitoba, and Quebec.

Harvest operations are reported annually by area and volume. Because harvest is regulated by area, actual harvest volumes may exceed the available harvest volume level. Independent audits are conducted every five years to ensure harvests are within allowable limits.

MANITOBA

Brief History of the Wood Supply Process

The forested portion of Manitoba is divided into forest sections, which are composed of forest management units (FMUs), and these further define a forested area with common forest conditions. Forest inventories within FMUs are analyzed to determine allowable harvest limits of softwood and hardwood tree species for each unit.

Manitoba's forest inventory was completed in the mid-1960s, and AACs were then determined for each forest section. In Manitoba, annual allowable harvest calculation can be summarized for two distinct periods, before and after the mid-1990s. From the mid-1960s to the mid-1990s, the "modified" Von Mantel's method was used and AAC was based on a combination of forest area, volume, increment, and rotation age. Annual allowable harvest levels, in this procedure, are calculated through the application of area allotment methods. In the process, separate AACs are determined for individual species working groups on the provincial Crown land within each forest management unit.

In the mid-1990s, the province announced a move from forest resource inventory (FRI) towards a new forest inventory (Forest Land Inventory) process in partnership with the forest sector, other existing users, and potential users. The Forest Lands Inventory Technical Advisory Committee, with representatives from Manitoba Conservation and industry, was formed to design a new forest inventory for Manitoba. In its report the committee recommended focusing on four key areas: strategic-level forest management concerns, modelling and sustainability issues, forest land inventory attributes, and implementation.

Additional demands on the forestry landbase by an expanding forest industry have increased the need for allowable harvest determinations to be performed quickly and efficiently. In 1998, Manitoba Conservation commissioned an external review of the existing process to determine annual allowable harvest, and it has since adopted many of the key recommendations in the report. The Forestry Branch,

Manitoba Conservation, has also adopted a more contemporary method of estimating wood fibre supply through the use of Woodstock™ and Stanley™ forest modelling software. Manitoba has made a commitment to sustainable development and ecosystem-based approaches for forest management.

The Forestry Branch has used this new approach to determine sustainable wood supply in the Mountain Section and portions of the Interlake and Lake Winnipeg East Forest Sections. In forest management units where the FRI has not been updated, the previous AACs are still applied. There will be a transitional period from reporting AACs using Von Mantel's methods to the new modelling approach in Manitoba. The length of the transition period will depend on the completion of new forest inventory, sustainable forest management, and industry development.

The 2001 *Five-year Report on the Status of Forestry (1996–2001)* provides an overview of the milestones in the forestry over the past five years, an indication of the status of Manitoba forest resources, and an assessment of the department's forest management programs. As well, it identifies challenges for the forest sector.

Current Process and Information Used for Estimating Wood Supply

This section describes input data for the analysis of wood supply.

Forest Inventory Coverage

The Forestry Branch of Manitoba Conservation, which is responsible for the calculation and management of annual allowable harvest levels for the provincial Crown forests, maintains an inventory of the province's forest resource. Manitoba is divided into three broad zones, the Agricultural Zone in the south, the Forest Zone in the middle, and the Transitional and Tundra Zone in the northern third of the province. The Forestry Branch inventory data represent only the Forest and Agricultural zones. The Forest and Agricultural zones have been further subdivided into 10 forest sections, and then into smaller forest management units on the basis of logical operational units.

In moving to the new Forest Land Inventory, some key attributes that have been added are stand origin, height and age, multiple canopy, and terrestrial and wetland ecological components. The current objective of the Forest Management Section is to re-inventory all forest land on a 15- to 20-year cycle.

Wood Supply Determination

In the traditional and accepted definition of AACs, the underlying premise is that a sustainable cut has been determined. Until the mid-1990s, Manitoba Conservation calculated sustainable harvest levels using an area and volume method for a specified period of time, in order to determine the number of hectares that could be harvested annually. A "modified" Von Mantel's method was also applied to calculate the number of cubic metres that could be harvested, and a removal period for the mature and over-mature timber was determined. Once a removal period has been determined and assessed, the allowable cut harvest level was reduced to account for fire, insect and disease, and resource protection buffers.

The Forestry Branch has calculated separate AACs for individual species and working groups on provincial Crown land within each FMU:

- Theoretical AAC—This is the theoretical maximum cut that could be harvested annually throughout the rotation period from a managed forest unit if all trees of all species were completely utilized.

Achievement of the theoretical AAC is not usually economically feasible under present practices of resource extraction, conversion, and marketing. For this reason, three levels of restriction are imposed on the forest stands that may be considered for inclusion in AAC calculations:

- First Practical AAC—Only jack pine, black spruce, white spruce, and balsam fir that have a volume of 55 m^3/ha and over are covered.
- Second Practical AAC—Stands of trembling aspen with volumes of at least 55 m^3/ha are also included in the area and volume base.
- Third Practical AAC—All softwood timber stands with a volume of 25 m^3/ha and over.

and all hardwood stands with a volume of 40 m^3/ha and over, are included.

The Forestry Branch also calculates for each management unit

- Net Merchantable Level—a net merchantable harvest level that reflects the latest product technology and highest level of fibre utilization.

Once the forested areas have a new Forest Land Inventory or the existing Forest Resource Inventory has been updated, the Forestry Branch undertakes the new wood-supply modelling analysis.

This analysis determines the AACs that can be sustained on the available forested landbase using current growth and yield information and management objectives. The determination of sustainable wood supply is undertaken in two parts. First, the strategic-level wood supply is determined in accordance with the primary objective of this analysis: to determine the maximum harvest that can be sustained over the planning period. The sustainable harvest is calculated considering forest management policies such as even flow and operational constraints including utilization standards, buffer widths, minimum harvest age, and forest regeneration delay. To facilitate assessment and sensitivity analysis on these harvest levels, the resource indicators are tracked. Secondly, the tactical-level wood supply is determined. The Woodstock™ forest planning model is used to determine the optimal harvest level and schedule in accordance with stated objectives and actions and constraints. The Stanley™ simulation model is used to spatially locate the forest stands scheduled for harvest in the Woodstock™ harvest sequence file.

The strategic- and tactical-level analyses are formulated to best reflect forest policy, operating guidelines, and harvesting practices currently followed by the industry.

Issues and Conflicts That Influence Wood Supply Determination

Over the years the forest industry in Manitoba has expanded while, at the same time, additional demands, affecting land and resource allocation, have been placed on the forestry landbase. For example, the Treaty Land Entitlement and Protected Area initiatives have had an impact on the landbase available to support wood supply.

In the new wood supply modelling approach, a series of deductions are applied to the remaining productive forest landbase as part of the process used to define the operable harvesting landbase. These deductions represent the factors that effectively reduce the availability or suitability of the forested productive area for ecological, economical, or social reasons.

Further sensitivity analyses are run to determine how landbase assumptions, silvicultural practice, management objectives, flow policy, etc. affect wood supply and the desired future forest condition.

These considerations, as well as additional forest management planning and analysis at the tactical level, can help to fine-tune periodic harvest levels and harvesting strategies to best meet forest management objectives. The research on model structure and its constraints will be strengthened as ongoing science-based improvements in the understanding of ecological dynamics help to reduce uncertainty.

Interpretations of Wood Supply Estimates and Limitations of Use

In 1998, the Forestry Branch commissioned an external review of the existing AAC determination process; since then many of the key recommendations of the report have been adopted. The Forestry Branch has modified its approach to forest inventory, directed additional funds to the growth and yield program, and adopted a more contemporary method of estimating wood supply through the use of forest modelling software. The Forestry Branch has implemented this new forest modelling approach to determine sustainable wood supply for Manitoba's forests in the western and eastern portions of the province. In the future, the entire province will have new wood supply information resulting from the new forest modelling approach.

SASKATCHEWAN

Brief History of the Wood Supply Process

Saskatchewan Environment's Forest Service Branch (FSB) had the responsibility for wood supply determination throughout the 1980s, and undertook analysis using the Von Mantel formulation. This method requires the determination of the total growing stock of the forest and the rotation age of each of the stand aggregates. The harvest level proposed by this method is similar to that predicted by a long run sustained yield (LRSY) calculation, but does not require an assessment of growth rate.

Recognition that this simple formulation failed to capture numerous important aspects of forest dynamics and ecological value and inadequately supported the construction of meaningful management strategies led to a commitment to forest estate modelling. The Woodstock™ planning system was adopted in the late 1990s.

This change in focus coincided with the ratification of the *Forest Resources Management Act* in 1999. Through the associated Regulations, the act requires parties seeking forest management agreements (FMAs) for areas of the provincial forest to submit a forest management plan every 10 years. The plan includes the specification of a harvest strategy and the associated calculation of AAC. FMAs are limited to 20 years. The Timber Supply Licence (TSL) was designated as a forest area with reduced responsibilities and a term limit of 10 years. In practice, TSLs are intended to ultimately evolve into FMAs. One round of FMA plans has now been completed and reviewed. In addition, a technical review of wood supply analysis procedures in other provinces, the United States, and Europe was undertaken. FSB is currently developing a *Forest Management Planning Manual*, including wood supply analysis as the centrepiece of the planning process.

Current Process and Information Used for Estimating Wood Supply

Inventory data for the Saskatchewan provincial forest vary in age from the early 1970s to the 1990s. The province devolved responsibility for collecting the inventory data to industry in the late 1990s, without developing a plan to re-inventory areas not administered under an FMA. The province is working with industry to develop data-sharing agreements that will allow the government access to the newer inventory, based on its new *Saskatchewan Forest Vegetation Inventory* standard.

Saskatchewan is in the seminal stages of producing a rigorous, objective-driven, and results-based framework for forest management. In 2004, FSB achieved third-party certification of an environmental management system to the ISO 14001 standard. This system includes a commitment to long-term planning and ensures accountability that will remain independent of any shifts in political priorities. As part of the system, a standard operating procedure for the calculation of wood supply for forests under direct provincial control (non-FMA and non-TSL) was developed, which includes key reporting requirements, data storage, and records control procedures. Many factors affecting wood supply will therefore change prior to the submission of the first FMA plan under the next planning cycle in 2007.

The first round of plans submitted under the FMA process used simulation models (FORMAN and COMPLAN) and an independently developed optimization model (Mistik Forest Management Model). Objectives varied, but they were frequently formulated in terms of net present value, with results that predictably devalued the future use of the resource.

As Saskatchewan's *Forest Management Planning Manual* is still in the construction phase, the form of future wood supply analysis is uncertain. However, some current issues and likely actions taken to resolve them are noted in the "Issues and Conflicts" section.

Biodiversity requirements are being defined. There is currently no standard provincial reference for characterizing the forest in terms of non-timber values.

The only basic attributes unlikely to change in the short term are a 200-year strategic modelling forecast period and the use of yield curves built on fitted temporary sample plot (TSP) data. Yield curves

currently in use were developed by fitting curves to temporary sample plot (TSP) data, stratified according to the older inventory standard. They provide separate forecasts of softwood and hardwood volume only; there is no subdivision of those volumes to reflect their distribution among various products. There are no separate forecasts for average merchantable tree size or other possible indicators of the economic suitability of a forest stand for harvest. The TSP data were collected in 1980 to provide ground-level characterization of the forest inventory, and no plan is in place to update these. Industry-collected TSP data will be shared under the same agreements as the inventory. Post-harvest, stands return to the same yield curve. In some cases, regeneration delays have been included, but not consistently.

The forest condition, forecast of future condition, and treatment response are used as inputs to the Woodstock™ forest estate model. Historically, maximized even-flow harvest volumes have been calculated, and then a fire factor and other reductions have been applied. The completion of the *Forest Management Planning Manual* will standardize government objectives and reporting requirements and will more fully address non-timber values and biodiversity objectives.

Issues and Conflicts That Influence Wood Supply Determination

In the last round of planning, wood supply figures were adopted independent of the modelled harvesting schedule used to generate them. In subsequent planning activities, the modelled schedule has not always been adhered to, with resulting discrepancies in the forecast forest condition and associated characteristics of sustainability. The intent is to tighten this link by requiring that operational plans include effective blocking based on the modelled harvest schedule.

Forest fires are a natural element of the forest management challenge in Saskatchewan. Forest management units in Saskatchewan vary widely in size; as fire risk and hazard vary with unit size, so do the expectations of wood flow stability in the future. While a large management unit may endure normal fire losses without suffering large fluctuations in its wood supply, a smaller management unit will not. Saskatchewan Environment allows licensees to recommend appropriate fire risk reduction strategies that recognize this variability.

Forest conditions also vary with the scale of the management unit area; age class distributions, for example, tend to be more skewed in smaller management units. To accommodate this variability, licensees may adopt harvest strategies resulting in a decline in the wood supply over the short term, provided that they demonstrate achievement of a long-term equilibrium level, and meet all non-timber objectives and targets specified by Saskatchewan Environment.

Mixedwood stands are an important target of harvesting pressure. Succession is understood to affect species composition during the life of a stand and following harvesting, but little detailed information is available. Given the strategic modelling forecast period, succession after harvesting may have an important impact on forecasts of forest condition and the associated supply of wood from them. Also, as the yield curves are constructed by fitting temporary sample data, it is possible that successional changes in species composition and crown closure cause the data to be inappropriately grouped for yield-curve construction. Saskatchewan Environment has initiated a study of historic photosequences to fill this gap in the short term.

Accounting for economic uncertainty is an unresolved issue; what is needed is to identify an appropriate period for the achievement of harvesting targets that smooths the effect of economic fluctuations. Economic cycles hamper the ability of licensees to harvest their full timber allotment periodically, but the forecast supply of desired forest conditions may depend on achieving those harvest levels. Moreover, if wood is likely to go unutilized, there may be additional economic opportunities for other industrial parties to gain a share of the resource.

Interpretations of Wood Supply Estimates and Limitations of Use

Since the province owns 97% of the productive forest, wood supply estimates reasonably represent the available supply in Saskatchewan.

As understanding of forests and society improves over time, wood supply estimates are refined. It is commonly believed that the adoption of an incorrect harvest volume schedule results in the immediate sacrifice of sustainability of the forest resource, but in many jurisdictions the resilience of the forest provides ample time for improvement. Saskatchewan's figures are credible estimates appropriate for their time, but it is likely and desirable that they will change in the next round of planning.

ALBERTA

Brief History of the Wood Supply Process

The history of wood supply determination within Alberta over the last several decades has been primarily one of development. Early determinations were based on elementary inventories that classified the landbase in terms of broad definitions. As inventories have become progressively more complex, the data captured have allowed more detailed management planning guidelines and address a greater diversity of values. Inventory history includes three phases completed by the Crown. Phase 1 was conducted between 1949 and 1956, Phase 2 between 1956 and 1966 (the advent of the Quota tenure system), and Phase 3 between 1970 and 1984. The current inventory classification system, referred to as the Alberta Vegetation Inventory (AVI), was initiated in 1987 and is still in use at the present time, with regularly scheduled updates.

Timber supply modelling, as in the case of inventory, has gone through a continuing evolution in its attempt to better represent operational reality, considering the ever-expanding values associated with Alberta's managed forest landscapes. Model inputs, constraints, and assumptions have continued to evolve as more detailed pictures of desired future forest states become clearer. In the 1970s, Von Mantel's equation was used to determine timber supplies. By the mid-1980s, models that included Timber RAM and area/volume checks were the favoured analysis tools. During the 1990s, Trends, FORMAN™, and COMPLAN™ were utilized. Modelling tools currently used include the Woodstock/Stanley™ suite of tools and Patchworks™. Long run sustained yield average (LRSYA) has always been calculated as a comparison of modelled outputs to sustainable harvest rates under a fully regulated forest age class distribution (equal area in each age class by strata and average harvest age within the strata).

Current Process and Information Used for Estimating Wood Supply

The volume of timber determined to be available for harvest in Alberta is based on what the forest will grow rather than the size of the existing industry. The sustainable harvest is calculated using that portion of the forest landbase that Alberta Sustainable Resource Development makes available for timber production.

The Alberta Vegetation Inventory has been conducted from 1987 to the present, with regularly scheduled updates. Forest inventory is completed by the forest industry within forest management agreement (FMA) areas, and by the Crown within non-FMA management units.

Alberta has embraced the concept of *sustainable forest management*. Management unit plans are required for every forest management unit (FMU) established by the Minister under the *Forests Act*. This planning authority extends to provincial Crown land and does not pertain to federal or private land. Forest management agreement (FMA) holders assume this responsibility from the government and prepare detailed forest management plans. The *Forest Management Planning Standard* provides guidelines for both government and agreement holders.

The province has developed guidelines for determining the AAC, and this AAC reflects the landbase available for timber harvesting and the forest management strategies applied to that landbase. Forest management strategies also take into account forest uses and values other than timber production. These non-timber resource values include the maintenance of required habitat (e.g., forest cover / seral stage / stand structure) for key wildlife species.

The approved AAC is the maximum amount of timber that can be harvested each year. Due to the consideration of non-timber values, about two hectares in five are made available by the government for timber harvesting. Of these available forest lands, about 1% of the net area is harvested annually.

Modelling tools currently used include the Woodstock/Stanley™ suite of tools and Patchworks™. The average long run sustained yield (LRSY) is calculated as a comparison of modelled outputs to sustainable harvest rates under a fully regulated forest state. AACs are forecast on an even-flow basis, using the net land base (the landbase available for timber harvest, comprising the net productive coniferous and net productive deciduous landbases), over a planning horizon of 200 years, taking into consideration the current forest condition, the desired future forest state, forest management strategies, and the existing conifer and deciduous allocations. Items evaluated in the determination of the AAC include the spatial harvest sequence within each operating compartment; the road corridors necessary to implement the harvest sequence; habitat requirements for species of special management concern; the age-class, opening size and cover type distribution across time; and the wildfire threat.

The current AAC process builds upon the experiences gained since the last major AAC review in 1986. The objective is to maintain maximum flexibility in the AAC determination process so that timely and relevant results can be provided.

The annual growth of all inventoried forested Crown lands in the province has been estimated at 44.5 million m^3. The total net AAC within the Green Area is approximately 23.9 million m^3 (average for the five-year period 1998–99 to 2002–03). The actual 2002–03 harvest level was 81% of the AAC, and 43% of annual forest growth. At present, less than 1% of productive Crown forested land is being harvested annually.

Inventories are replaced every 20–25 years, and more frequently when warranted. Updates for timber harvest activity and other landbase impacts (e.g., roads, seismic lines, well sites, forest fires) are captured on an ongoing basis. Re-inventory is ongoing; several FMA holders replace their inventory on a 10–20 year cycle. Detailed forest management plans are revised on a 10-year cycle, with interim AAC adjustments taking place when warranted (such as after a catastrophic fire).

Issues and Conflicts That Influence Wood Supply Determination

As the current wood supply is nearly fully allocated, Alberta has reached the point where future gains in AAC will have to be made through closer utilization standards (i.e., harvesting stands included in the AAC to a smaller stump and top diameter), applying intensive silviculture practice on harvested stands, or accessing stand types previously considered either marginal or not merchantable.

Alberta is experiencing greater internal and external demands for preservation of ecological integrity, which can have a limiting effect on wood supplies. As is typical of the boreal forest, fire plays a large role in defining the landscape. Fire will continue to have a strong influence on current and future wood supplies. With high allocation levels the possibility of catastrophic losses due to fire will challenge wood flow volumes to existing mills.

Insects and disease also play a role in Alberta wood supplies. The mountain pine beetle has the potential for significant impacts on pine stands, while spruce budworm continues to have a presence in northern Alberta.

Interpretations of Wood Supply Estimates and Limitations of Use

The difference between the approved AAC and actual annual harvest levels shows there is room for increases in harvest levels (including some expansion of the primary forest sector) in the future. The government will continue to ensure that timber-harvesting levels are sustainable and do not surpass the AAC levels. Increases in actual annual harvest levels can only occur in areas where the full AAC has not already been allocated.

BRITISH COLUMBIA

Brief History of the Wood Supply Process

British Columbia (B.C.) has a long history of wood supply estimation and regulation. The province distinguishes between the estimation of wood supply, which is largely a technical process, and the determination of wood supply, which is a professional judgement made within a legislative framework considering a wide range of information and objectives.

Wood supply for the province was first estimated by Hanzlik's formula in the 1937 Survey of British Columbia's Forest Resources. In 1945, a Royal Commission headed by Chief Justice Gordon McGregor Sloan was established to address concerns about the lack of regulation of the expanding timber harvest, particularly on the coast. Recommendations from this commission formed a "sustained yield" policy. In the decade following the 1945 Sloan Commission, the volume of timber harvested in B.C. doubled to about 29 million m^3, with the majority of the increase coming from the growing industry in the interior of the province. This rapid increase prompted a second Royal Commission in 1955, also headed by Justice Sloan, which confirmed the sustained yield policy, identified silviculture and replanting as critical to the policy's success, and maintained the use of Hanzlik's formula for estimation of sustainable yield.

From 1955 to 1975, the volume of timber harvested doubled again, with increases in the coastal and interior harvests. Much of this increase was due to the commercialization of lodgepole pine and coastal western hemlock, as well as improved utilization standards that left less waste wood on site after logging. AACs continued to be set for 10-year periods using Hanzlik's formula, with the refinement of an "area-volume allotment check" that accounted for land alienations, logging roads, regeneration delay, and unsalvaged losses to ensure that calculated timber volumes were available from each management unit over one rotation.

By the mid-1970s, the dramatic changes in the size, structure, and technology of the forest industry, and its impact on forest values, led to another Royal Commission. Chaired by Dr. Peter Pearse, this commission found that a reduction in harvest volume might occur in the future as a result of the transition from harvesting areas of old-growth stands with high volume to areas of second growth with lower volumes. The commission suggested the fall-down might be averted through intensified regeneration and silviculture efforts.

Largely in response to the recommendations of the Pearse Commission, the government tabled a new *Forest Act* in 1979. In contrast to the previous era of AAC calculations using Hanzlik's formula, the new act called for AACs to be determined by the province's Chief Forester, based on consideration of a wide range of information. The AACs would be determined for timber supply areas (TSAs) as large management units (these cover about 90% of the province's managed forest) as well as for smaller tree farm licences (TFLs). The act specified that once the Chief Forester had determined the AAC for a TSA, which would ensure long-term sustainability, the Minister of Forests could apportion the AAC to various forms of agreement (i.e., licences), allowing for harvest control requirements.

New, more sophisticated timber supply analysis and modelling techniques (Timber RAM and MUSYC, developed by the U.S. Forest Service) were used for the Chief Forester's AAC determinations and the 1980 and 1984 Forest and Range Resource Analysis reports. The early 1980s saw AACs reviewed for all TSAs in the province, with the intention they would be re-examined within the subsequent 10 years.

Rapid changes in public attitudes towards forestry and environmental issues that occurred through the late 1970s and early 1980s set the stage for the development of new resource management practices and the initiation of land use and management planning processes. Although management practices changed significantly and land use uncertainty rose, new AACs were not being re-determined regularly for most TSAs in the province, because there was no legal requirement to do so and the tendency was to delay decisions until better information became available. Many became concerned these delays in making determinations was leading to over-harvesting, as the AACs did not reflect new practices.

In response to this concern, the government legislated a requirement that the province's Chief Forester review the timber supply of each TSA and TFL at least once every five years. During the second round of timber supply reviews, it was recognized that not all management units had wood supply issues that warranted the analytical and procedural efforts required to determine the AAC every five years. Therefore, new legislation was tabled in the spring of 2002 providing the Chief Forester with the discretion to postpone the review of timber supply for a management unit by up to five years if it was determined that the AAC would not likely change significantly.

Current Process and Information Used for Estimating Wood Supply

Approximately 42% of B.C.'s 60 million ha of forest is available for wood supply, and about 0.3% is harvested annually. From 1994 to 2003, Crown lands accounted for about 90% of the provincial harvest. The *Forest Act* requires AACs to be determined for TSAs and TFLs, as well as community forest agreements (CFAs) and woodlot licences (WLs). Except for small amounts of private lands within TFLs and WLs (approximately 4% and 18% respectively), wood supply estimation and provincial harvest regulation do not apply to private lands.

Currently the provincial landbase is subdivided into the following management units: 37 TSAs, 34 TFLs, 10 pilot CFAs, and more than 800 WLs. Wood supply and allowable annual cut is assessed and determined independently for each of these management units. On TSAs and TFLs, which account for 98% of the provincially regulated wood supply, the *Forest Act* requires the Chief Forester to determine an AAC. Ministry of Forests regional and district managers are responsible for determining AACs for CFAs and WLs.

Wood supply estimates are forecast using a variety of models, with inputs related to available forest inventories, expected growth and yield rates, and detailed management considerations. The province is covered by a mosaic of forest inventories collected and updated over time. The current inventory standard, known as the Vegetation Resource Inventory, has two phases: photo interpretation and a statistical calibration based on ground sampling. Growth and yield estimates factor in species, natural or artificial regeneration method, seedling stock, genetic potential, establishment density, and expected losses due to decay, waste, and breakage. Average losses to fire, wind, flood, and endemic pest populations are deducted from forecasts to arrive at the harvestable wood supply. Management considerations such as maintenance of biodiversity, fish and wildlife habitat, water quality, visual aesthetics, and soil stability are factored into both landbase availability and harvest rates. Several wood supply models are used in B.C. and new models are constantly being developed and deployed.

Wood supply analysis has been the responsibility of TFL holders (which currently account for 22% of the provincial AAC) since their inception in the 1950s. Analysis of wood supply from TSAs was conducted by the province for TSAs until 2003. The province is introducing new legislation to promote the formation of licensee groups to undertake wood supply analysis on TSAs under an initiative known as Defined Forest Area Management. This legislation has not yet been brought into force. And as of mid-2004, wood supply analysis for TSAs is still voluntary for licensees.

For TSAs and TFLs, the information used in wood supply analyses and the analysis results are made available to the public for comment. The province also reviews analysis assumptions and technical submissions prior to use in the AAC determination process. The authority named in legislation (i.e., Chief Forester, regional manager, district manager), using their professional judgement, determines the AAC for a management unit based upon technical wood supply analysis and other information specified in legislation (e.g., social and economic objectives of the Crown). Wood supply analysis and determinations of AAC are extensively documented and available on the Internet at www.for.gov.bc.ca/hts.

Issues and Conflicts That Influence Wood Supply Determination

Current significant challenges facing the estimation and determination of wood supply in B.C. include the following:

Changing Forest Practices Legislation

The *Forest Practices Code of BC Act* (FPC) introduced in the mid-1990s has recently been replaced by the *Forest and Range Practices Act* (FRPA). The new legislation takes a results-based approach in which government specifies objectives and forest licensees develop plans that document the results for which the licensee will be responsible. The administration of the previous legislation involved more regulations, policies, and guidelines than are planned for the new legislation. Under the FPC, wood supply analysis was directly guided by the policies and guidelines. The details of wood supply analysis of forest management under FRPA are still uncertain, since it will be possible for licensees to take different management approaches, which could require new modelling considerations. Changing policy (and science) on issues such as biodiversity protection and wildlife habitat have also presented new challenges for modelling.

Growth and Yield and Forest Productivity

New information on forest growth and yield developed during the 1990s has offset, to some extent, the reductions in wood supply forecast through the 1970s and 1980s. In the previous wood supply forecasts, tree growth after harvest was projected to be the same as in the existing old forests. However, two types of new information changed the growth and yield expected from managed forests. First, new growth and yield data from sample plots in managed forests throughout the province became available. These data indicated that prompt reforestation and control of stocking resulted in faster growth. Growth and yield models developed using these data are now routinely used in wood supply analysis in B.C. Second, research on site productivity confirmed that in addition to the faster growth brought about by silvicultural management, the productivity of forest sites was much higher than previously estimated. Productivity estimates have historically been based on existing old-growth forests in which tree breakage, past competition, and other factors can combine to underestimate the potential productivity of managed forests on the same sites.

Based on this new growth and yield and site productivity information, the projected volumes from new, managed forests are on average 20% to 30% higher than for unmanaged forests. Recent efforts have concentrated on developing site productivity estimates that are sufficiently localized and ecosystem-specific to provide a reliable basis for AAC determinations.

Spatial Modelling

The need to model spatially defined management objectives like maximum patch size, adjacency, and natural disturbance poses some significant technical challenges. Tools are emerging that enable analysis of the implications of various practices and events, but there is uncertainty associated with natural variability, data, and sometimes definitions of concepts (e.g., patch). Even with advances in modelling over the last decade, it can still be difficult to inform decision makers clearly about the significance of model results, since links between many spatial indicators and important values are often more qualitative than quantitative.

Large-Scale Changes from Natural Disturbance

The province is currently in the midst of the largest outbreak of mountain pine beetle in recorded history. Similarly, extensive and damaging fires in 2003 demonstrated the risk of significant wood supply losses and highlighted the potential for historic large natural disturbances. Maintaining current and accurate information on the disturbances and forecasting future wood supply given such large, variable, and random natural events requires significant effort.

Economics and Operability

Estimating the economic viability, and hence wood supply, of the broad spectrum of B.C.'s forest resources and landscapes can be a challenge given fluctuating markets and the costs of transportation and harvesting, as well as the complexity of determining a minimum size and spatial distribution for a viable logging operation.

These challenges introduce uncertainty and bring complexity to AAC determinations. The implications of this uncertainty are examined through sensitivity analysis to allow the Chief Forester to assess risks. Sensitivity analyses can also suggest the need for further research by highlighting uncertainties that have large potential impacts on wood supply

projections. Further, regular re-determinations required by legislation are designed to ensure new information and knowledge are incorporated into AAC decisions.

Interpretations of Wood Supply Estimates and Limitations of Use

Wood supply estimates provided in this report are limited to Crown lands which, as previously mentioned, account for approximately 90% of the provincial harvest.

Wood supply estimates are based on the best information and modelling methodologies available at the time a determination of AAC is made. Information and modelling methods change over time and are subject to uncertainty at the time of a determination.

The reported provincial wood supply is the aggregate of wood supply estimates made for each management unit (e.g., TSAs, TFLs, and WLs). This has two implications. First, estimates for each unit are made at different times, and therefore reflect the different information and assumptions that are current when each management unit's AAC is determined. It may take a number of years for changes in information or management practices to be reflected over the whole province. Second, the aggregate forecast may not specifically illustrate the changes that are projected to occur in different management units.

Annual allowable cuts are sometimes temporarily increased for forest health reasons and to allow salvage of wood damaged from large fires or insect epidemics. B.C. is currently facing an unprecedented outbreak of mountain pine beetles, and 2003 was one of the province's largest fire seasons in recorded history. Wood damaged by these events is being salvaged under temporary AAC increases, which in the fall of 2004 totalled over 12 million m^3.

YUKON TERRITORY

Brief History of the Wood Supply Process

The history of wood supply in the Yukon has typically been "boom or bust," and over the years the wood supply for Yukon sawmills has been harvested on an ad hoc basis.

Beginning with the 1898 gold rush and continuing into the early twentieth century, large areas around Dawson City were denuded to supply the gold fields. Steamboats, which plied the Yukon River and its tributaries between the Bering Sea and Whitehorse until the early 1950s, were wood-fired, and the forests along these major waterways were cut to provide fuel. The construction of the Alaska Highway during the Second World War resulted in further unrestricted harvest of Yukon forests. In 1994, the southeast Yukon saw a boom in the logging industry when log prices in North America reached new highs, and these high prices applied new pressures to Yukon forests.

On 1 April 2003, the Yukon government assumed the regulatory and management responsibilities of forests in the Yukon as a result of the Devolution Transfer Agreement.

Current Process and Information Used for Estimating Wood Supply

The Department of Energy, Mines and Resources has a qualified timber supply analyst on staff. The full Remsoft suite of models is used (Woodstock™, Spatial Woodstock™, and Stanley™). In reviewing timber supply options, inputs for the linear programming model include inventory, landbase information, growth and yield, forest management assumptions, and analysis of risk. Current wood supply estimation work supports forest management planning in order to provide analysis of landbase and forest management options.

Issues and Conflicts That Influence Wood Supply Determination

The following issues have prevented certainty of wood supply forecasts in the Yukon:

- no forestry legislation;
- lack of forest tenure;
- First Nations land claims;
- lack of higher-level plans (land use and forest management plans); and
- incomplete forest inventory.

Major progress has been made on resolving these issues. Two years of consultation on forest policy has been completed, and new legislation will be tabled in the fall of 2005. Land claim negotiations continue and agreements in principle on forest management have been signed in two key resource areas. Forest management planning is under way in the southeast, south central, and southwest Yukon. And finally, the forest inventory of the central Yukon will be complete by 31 March 2005 (including the Boreal Cordillera Ecozone, which is the major forested area of the Yukon).

Interpretations of Wood Supply Estimates and Limitations of Use

There is no forest industry in the Yukon other than a few small family-operated mills. Overcutting is not an issue in this jurisdiction.

NORTHWEST TERRITORIES

Brief History of the Wood Supply Process

Northwest Territories (N.W.T.) lands are used primarily for traditional activities such as hunting and trapping. Currently there are no large-scale timber harvesting operations and no landbase tenures; small operators may harvest locally for fuel wood, cabin and log home building, and small amounts of saw timber. Forest resources are beginning to reflect the impact of oil and gas exploration and developments.

Due to the relatively low pressure on forest resources, there is little area covered by detailed management inventories. Wood has been made available to small-scale harvesters, with little concern about negative impact on the landscape-level forest resource.

Current Process and Information Used for Estimating Wood Supply

Wood supply analysis has been completed for small areas in the N.W.T. using Remsoft Woodstock™ forest modelling software, and Woodstock™ modelling is planned for further analyses. Some key factors for estimating wood supply are timber utilization, assessment of deletions and constraints related to environmental protection, estimation of a merchantable landbase, and regeneration constraints and assumptions.

The N.W.T. has used the approach of modelling several scenarios and basing allowable harvest levels on the one that best simulates current and near-future predicted forest practices. The N.W.T. does not set an AAC. All tenure is volume-based. While the government of N.W.T. has been delegated responsibility for management of forest resources, land management responsibility remains with Indian and Northern Affairs Canada.

Issues and Conflicts That Influence Wood Supply Determination

Wood supply determinations cannot be made by the Government of Northwest Territories for many areas due to various land claims processes. Land claims have been settled in several areas and are ongoing in others. In settled land claim regions, the government is no longer the owner or steward of the land, and First Nations are not making wood supply determinations in their areas at this time.

On Crown land, the government recognizes that wildlife habitat, hunting, and trapping are primary uses of forest lands. Legislation is under review for the development of a new forest management policy and further legislation will be developed. The new legislation will recognize the unique requirements of the North. Wood supply analysis as practised in southern Canada has not been a component of forest management planning in the N.W.T. The traditional southern modelling is a construct, a framework built to suit the needs of standard, large industrial users. Northern communities and users see wood use as a right, and provision of wood as an obligation of the Crown. User needs are not standardized beyond those for fuel wood. Stakeholders often compete for land management authority and see commitment to sustainable timber use as a long-term constraint to management control. In addition, due to the history of management planning that precluded traditional southern wood-supply thinking,

the necessary broad-based information, technical expertise, and human resources are very limited.

Interpretations of Wood Supply Estimates and Limitations of Use

The N.W.T. Department of Environment and Natural Resources does not determine nor report AACs. It will continue to perform wood supply analyses and evaluation of sustainability in areas where commercial forestry potential exists or where large forest impacts are occurring due to other activities such as oil and gas exploration and development.

The intent of forest management related to timber in the N.W.T. today is to ensure that wood harvest and industrial wood impacts are well within the sustainable harvest levels, given reasonable modelling inputs. The focus of forest management, quite simply, is sustainability.

PROVINCIAL WOOD SUPPLY INDICATORS

This section answers the following three broad questions:

1. What is the current regulated annual allowable cut on provincial Crown forest lands?
2. How closely are regulated harvest levels adhered to on provincial Crown forest lands?
3. What is the future outlook of wood supply on all forested lands in Canada?

Three indicators are presented:

- Current annual allowable cut[7]—current regulated harvest levels.
- Harvest control—the degree to which harvest regulation is being operationally achieved.
- Projected annual wood supply and growing stock—future trends.

CURRENT AAC

The current annual allowable cut (AAC) values for publicly owned regulated lands are presented in Table 1. The periods reported in Table 1 do not generally coincide with the periods reported in the harvest control indicator.

The AAC has been determined for northern parts of Manitoba and Saskatchewan–areas in which no forest industry is currently located. The unallocated AAC in these provinces is presented in Table 2. The location of the landbase that supports the unallocated AAC is shown in Figure 1.

HARVEST CONTROL

The purpose of this indicator is to demonstrate the degree to which harvest regulation is being operationally achieved on provincial Crown lands (Table 3). In almost all cases, harvest control is implemented on a periodic rather than an annual basis. While AAC levels cannot be exceeded over the regulation period (5 to 10 years in most cases), annual harvest levels may have only very broad thresholds (50%) or none at all. Therefore, this indicator is only reported for the last full regulation period on record. The fact that regulation periods are not consistent across jurisdictions, in terms of either period length or starting and ending years, does not limit the utility of this indicator, as the statistics presented are periodic annual statistics and ratios. Again, it should be noted that the harvest levels presented in Table 3 are not total harvest levels in the provinces, but only the harvest from regulated lands, i.e., where AACs are established.

[7] The available harvest volume (AHV) in Ontario and the allowable annual cut in British Columbia are analogous to the annual allowable cut (AAC) used in other jurisdictions.

PROJECTED ANNUAL WOOD SUPPLY AND GROWING STOCK

The following information on wood supply and growing stock projections is designed to depict future trends. Growing stock represents the inventory standing on the net landbase at any point in time. In all provinces and territories, stability of this growing stock is a long-term target; it is therefore a useful indicator of sustainability of resource values. Depiction of the net area in three broad stages of development (regenerating, immature, and mature) is presented to capture the transition in distribution of these stages from the current condition, with a preponderance of mature forest, to a more balanced long-term distribution. Managing wood supply through the transition period thus presents significant challenges. Specifically, information is reported for the following temporal stages:

- Short term (over the next 10 years), which will be reflected in near-term AAC changes.
- Mid-term (over the next 100 years), which reflects the current/future forest transition.
- Long term (beyond 100 years), which reflects the productivity of the regulated forest.

The same points in time are used for reporting for all jurisdictions to enable roll-up at the national level.

This component of the reporting framework is intended to include information for private, federal, and territorial lands, as well as provincial Crown lands.

TABLE 1. Current AAC on Regulated Lands

	Units	NL[a]	PE[b]	NS	NB	QC	ON	MB[c]	SK	AB	BC
Start of current period	year	2001	2000	2001	2002	1994	2003	2001	2001	2000	2003
End of current period	year	2005	2005	2005	2007	1999	2004	2005	2005	2001	2003
Total Crown land	000 ha	37 856	263	1 100	3 362	74 286	75 543[d]	25 942[g]	27 881	32 974	87 553
Productive forest Crown land	000 ha	8 506	256	1 030	3 050	45 907	34 120[e]	12 299[g]	11 975	22 464	49 145
Area available for harvest*	000 ha	2 353	216	690	2 901	N/A	23 855[f]	N/A[g]	N/A[i]	N/A	22 934[k]
Current AAC softwood	000 m^3	2 347	300	900	3 494	32 070	20 639	5 639[h]	4 834	13 646[j]	71 116[l]
Current AAC hardwood	000 m^3	N/A	160	350	1 870	12 598	11 456	3 260[h]	3 388	10 428[j]	3 218

[a] While 99% of Newfoundland is publicly owned, timber and property rights for 69% of the Crown land on the island of Newfoundland has been conveyed to pulp and paper companies through 99-year licences issued under the 1905 *Pulp and Paper Manufacturing Act* and the 1935 *Bowater Act*. Therefore, the province's financial and legal system treats this licensed land as private property. The numbers reported above are for the total Crown land.

[b] Prince Edward Island produces a sustainable harvest figure for the whole province. An area reduction of 15% is applied (resulting in "Net Area") before the sustainable harvest is calculated to account for private landowner participatory rates in harvest activities.

[c] Source: *Manitoba Conservation Five-Year Report on the Status of Forestry*, 1996–2001, pp. 51, 55.

[d] Source: *Forest Resources Ontario 2001*, Table 3.1, Crown and Parks.

[e] Source: *Forest Resources Ontario 2001*, Table 4.1, Crown and Parks.

[f] Source: Provincial Summary of FMP-9 information.

[g] A volume reduction of 15% is applied before the AAC is calculated in order to account for buffer zones, ecological reserves that protect other resource values, and natural events such as wildfires, and insect and diseases losses.

[h] Net merchantable annual allowable harvest reflects the latest product technology and highest level of fibre utilization. Utilization levels vary throughout the province.

[i] Figures are not known for the entire commercial forest. For some non-FMA areas, AAC was calculated for the entire productive area.

[j] Source: *Compendium of Canadian Forestry Statistics*, Table 2.1.1.1 Potential Harvest, Estimates by Ownership and Species Group for the Latest Period Calculated, 1990–2004; values reported are for the period 2000–2001 (15 June 2004).

[k] Source: Minister of Forests, Allowable Annual Cut Database, query 2, December 2002. The area available for harvest does not include woodlots and community forests.

[l] Includes a significant temporary AAC uplift to salvage timber killed by mountain pine beetle.

*Area available for harvest is the area contributing to the growing and harvest of timber.

TABLE 2. AAC Breakdown for Manitoba and Saskatchewan

		Manitoba		Saskatchewan	
	Units	Allocated	Unallocated	Allocated	Unallocated
Start of current period	year	2001	2001	2001	2001
End of current period	year	2005	2005	2005	2005
Current AAC softwood	000 m^3	3 906	1 733	3 628	1 206
Current AAC hardwood	000 m^3	2 793	467	3 137	251

TABLE 3. Harvest Control on Crown Land

	Units	NL (1996–2000)[a]	PE (1990–2000)[b]	NS (1991–2000)	NB (1992–2002)[c]	QC (1991–2000)	ON (1991–2000)	MB (1996–2001)	SK (1999–2000)	AB (1998–2002)[d]	BC (2003)[e]
Softwood											
Periodic annual harvest	000 m^3	1 958	431	562[f]	3 712	24 702[g]	16 568[g,h]	1 563[i]	2 259[g]	12 090	64 941[k]
Periodic annual AAC	000 m^3	2 573	300	865[g]	3 686	31 602[g]	22 887[g]	5 639[j]	3 864	13 670	66 653[k]
Periodic annual deviation	000 m^3	–615	+131	–303	+26	–6 900	–6 319	–4 076	–1 605	–1 580	–1 713
Harvest/AAC ratio	%	76	144	65	101	78	72	28	58	88	97
Hardwood											
Periodic annual harvest	000 m^3	62	151	99[f]	1 457	4 132[g]	4 406[g,h]	638[i]	1 313[g]	6 100	1 199[k]
Periodic annual AAC	000 m^3	N/A	160	455[g]	1 633	12 084[g]	13 058[g]	3 261[j]	3 244	10 210	2 843[k]
Periodic annual deviation	000 m^3	N/A	–9	–356	–176	–7 952	–8 652	–2 623	–1 931	–4 110	–1 645
Harvest/AAC ratio	%	N/A	94	22	89	34	34	20	40	60	42
Total											
Periodic annual harvest	000 m^3	2 020	582	661[f]	5 169	28 834[g]	20 974[g,h]	2 201[i]	3 572[g]	18 190	66 140[k]
Periodic annual AAC	000 m^3	2 635	460	1 320[g]	5 319	43 686[g]	35 945[g]	8 900[j]	7 108	23 880	69 496[k]
Periodic annual deviation	000 m^3	–615	+122	–659	–150	–14 852	–14 971	–6 699	–3 536	–5 690	–3 358
Harvest/AAC ratio	%	77	127	50	97	66	58	25	50	76	95

[a] While 99% of Newfoundland is publicly owned, timber and property rights for 69% of the Crown land on the island of Newfoundland has been conveyed to pulp and paper companies through 99-year licences issued under the 1905 *Pulp and Paper Manufacturing Act* and the 1935 *Bowater Act*. Therefore, the province's financial and legal system treats this licensed land as private property. The numbers reported above are for the total Crown land.

[b] Prince Edward Island values include private and provincial forest (public) lands.

[c] Harvest volumes from Department of Natural Resources Annual Reports (1997–2001); AAC from 1997 management plans.

[d] Average for the five-year period (timber years) 1998–1999 to 2002–2003.

[e] Includes a small amount of private land in British Columbia Tree Farm and Woodlot Licences.

[f] Average for the period 1991–1999.

[g] Average for the period 1991–2000.

[h] Typically, fire, insect, disease, and blow-down areas are assumed to be depleted in the analysis process and therefore should not count against the AAC. In reality, however, since salvage volumes are quite small (they account for less than 2% of the provincial volume) and quite dispersed, they have been reported against the AAC.

[i] Average for period 1996–2001.

[j] Net merchantable annual allowable harvest reflects the latest product technology and highest level of fibre utilization. Utilization levels vary throughout the province.

[k] Average for the period 1992–2001.

TABLE 4. Newfoundland—Island Only—Wood Supply Projections

Crown Land Industrial Tenure[a]

	Units	2000	2010	2050	2100	2150
Annual supply softwood	000 m^3	2 022	2 022	2 022	2 022	2 022
Growing stock softwood	000 m^3	104 000	98 000	104 000	122 934	90 000
Annual supply hardwood[b]	000 m^3	N/A	N/A	N/A	N/A	N/A
Growing stock hardwood[b]	000 m^3	N/A	N/A	N/A	N/A	N/A
Regenerating area	%	32	31	28	28	33
Immature area	%	30	40	49	43	43
Mature area	%	38	29	23	29	24

[a] While 99% of Newfoundland is publicly owned, timber and property rights for 69% of the Crown land on the island of Newfoundland has been conveyed to pulp and paper companies through 99-year licences issued under the 1905 *Pulp and Paper Manufacturing Act* and the 1935 *Bowater Act*. Therefore, the province's financial and legal system treats this licensed land as private property. The numbers reported above are for the total Crown land.

[b] Newfoundland and Labrador has no formalized hardwood AAC.

TABLE 5. Prince Edward Island—Wood Supply Projections

Private and Provincial Lands

	Units	2000	2010	2050	2100[b]	2150[b]
Annual supply softwood	000 m^3	315	61	315	N/A	N/A
Growing stock softwood	000 m^3	13 883	12 211	17 345	N/A	N/A
Annual supply hardwood	000 m^3	175	160	181	N/A	N/A
Growing stock hardwood	000 m^3	7 960	8 360	8 350	N/A	N/A
Regenerating area[a]	%	28	42	30	N/A	N/A
Immature area[a]	%	25	17	26	N/A	N/A
Mature area[a]	%	47	59	44	N/A	N/A

[a] Area by forecasted age classes: Regenerating = 0–20 yrs; Immature = 21–40 yrs; Mature = 41+ yrs.

[b] No projections are available past the year 2050.

TABLE 6. Nova Scotia—Wood Supply Projections

Provincial Crown Lands, Volume-based and Area-based Tenures

	Units	2000	2010	2050	2100[b]	2150[b]
Annual supply softwood	000 m^3	900	1 100	2 200	N/A	N/A
Growing stock softwood	000 m^3	95 000	107 000	176 000	N/A	N/A
Annual supply hardwood	000 m^3	350	400	490	N/A	N/A
Growing stock hardwood	000 m^3	40 000	40 000	47 000	N/A	N/A
Regenerating area[a]	%	12	11	15	N/A	N/A
Immature area[a]	%	48	32	28	N/A	N/A
Mature area[a]	%	40	57	57	N/A	N/A

[a] Area by forecasted age classes: Regenerating = 0–20 yrs; Immature = 21–60 yrs; Mature = 61+ yrs.

[b] No projections are available past the year 2050.

TABLE 7. Nova Scotia—Wood Supply Projections

Industrial Private Lands

	Units	2000	2010	2050	2100[b]	2150[b]
Annual supply softwood	000 m^3	1 200	1 750	2 850	N/A	N/A
Growing stock softwood	000 m^3	80 000	80 000	167 000	N/A	N/A
Annual supply hardwood	000 m^3	400	510	530	N/A	N/A
Growing stock hardwood	000 m^3	27 000	24 000	30 000	N/A	N/A
Regenerating area[a]	%	18	21	21	N/A	N/A
Immature area[a]	%	40	31	47	N/A	N/A
Mature area[a]	%	42	48	32	N/A	N/A

[a] Area by forecasted age classes: Regenerating = 0-20 yrs; Immature = 21-60 yrs; Mature = 61+ yrs.

[b] No projections are available past the year 2050.

TABLE 8. Nova Scotia—Wood Supply Projections

Non-industrial Private Lands

	Units	2000	2010	2050	2100[b]	2150[b]
Annual supply softwood	000 m^3	3 500	3 500	4 700	N/A	N/A
Growing stock softwood	000 m^3	164 000	149 000	162 000	N/A	N/A
Annual supply hardwood	000 m^3	1 000	1 150	1 050	N/A	N/A
Growing stock hardwood	000 m^3	62 000	56 000	57 000	N/A	N/A
Regenerating area[a]	%	20	26	25	N/A	N/A
Immature area[a]	%	40	27	38	N/A	N/A
Mature area[a]	%	40	47	37	N/A	N/A

[a] Area by forecasted age classes: Regenerating = 0-20 yrs; Immature = 21-60 yrs; Mature = 61+ yrs.

[b] No projections are available past the year 2050.

TABLE 9. New Brunswick—Wood Supply Projections

Provincial Crown Lands, Volume-based and Area-based Tenures

	Units	2000[a]	2010[b]	2050[b]	2100[c]	2150[d]
Annual supply softwood	000 m^3	3 621	3 495	4 700	4 700	N/A
Growing stock softwood	000 m^3	160 000	156 000	176 000	144 000	N/A
Annual supply hardwood	000 m^3	1 576	1 834	2 000	2 000	N/A
Growing stock hardwood	000 m^3	90 000	90 000	97 000	93 000	N/A
Regenerating area	%	36	37	30	35	N/A
Immature area	%	21	24	36	28	N/A
Mature area	%	43	38	34	38	N/A

[a] From 1997 Management Plan.

[b] From 2002 Management Plan.

[c] Actual projection to 2082.

[d] No projection available.

TABLE 10. New Brunswick—Wood Supply Projections

Industrial Private Lands

	Units	2000	2010	2050	2100	2150
Annual supply softwood	000 m^3	1 800[a]	N/A	N/A	N/A	N/A
Growing stock softwood	000 m^3	N/A	N/A	N/A	N/A	N/A
Annual supply hardwood	000 m^3	1 000[a]	N/A	N/A	N/A	N/A
Growing stock hardwood	000 m^3	N/A	N/A	N/A	N/A	N/A
Regenerating area	%	N/A	N/A	N/A	N/A	N/A
Immature area	%	N/A	N/A	N/A	N/A	N/A
Mature area	%	N/A	N/A	N/A	N/A	N/A

[a] **New Brunswick Forest Products Association. No date.** *New Brunswick's Forests at a Glance*. Pamphlet.

TABLE 11. Quebec—Wood Supply Projections

Provincial Crown Lands, Volume-based Tenures

	Units	2000	2010[a,b]	2050[b]	2100	2150
Annual supply softwood[c]	000 m^3	31 668	31 919	35 520	35 520	35 520
Growing stock softwood	000 m^3	2 728 638	2 728 638	2 728 638	2 728 638	2 728 638
Annual supply hardwood	000 m^3	12 060	12 158	13 558	13 558	13 558
Growing stock hardwood	000 m^3	993 924	993 924	993 924	993 924	993 924
Regenerating area[d]	%	15	15	15	15	15
Immature area[e]	%	N/A	N/A	N/A	N/A	N/A
Mature area[f]	%	N/A	N/A	N/A	N/A	N/A

[a] Annual supply is re-evaluated every five years.

[b] These data are based on the publication *Une politique de rendement accrue*, Info forêt no. 66, June 2000.

[c] The province of Quebec, LRSY = Annual supply (in the *Forest Act* it is called "allowable annual cut").

[d] 0–10 years.

[e] 30–50 years.

[f] 70+ years.

TABLE 12. Quebec—Wood Supply Projections

Private Lands, Volume-based Tenures

	Units	2000	2010[a,b]	2050[b]	2100	2150
Annual supply softwood[c]	000 m^3	5 404	5 297	6 061	6 061	6 061
Growing stock softwood	000 m^3	233 268	233 268	233 268	233 268	233 268
Annual supply hardwood	000 m^3	7 901	7 965	8 882	8 882	8 882
Growing stock hardwood	000 m^3	379 592	379 592	379 592	379 592	379 592
Regenerating area[d]	%	23	23	23	23	23
Immature area[e]	%	61	61	61	61	61
Mature area[f]	%	17	17	17	17	17

[a] Annual supply is re-evaluated every five years

[b] These data are based on the publication *Une politique de rendement accrue*, Info forêt, no. 66, June 2000.

[c] The province of Quebec LRSY = Annual supply (in the *Forest Act* it is called "allowable annual cut").

[d] 0–10 years.

[e] 30–50 years.

[f] 70+ years.

TABLE 13. Ontario—Wood Supply Projections

Provincial Crown Lands

	Units	2000	2010	2050	2100	2150[a]
Annual supply softwood	000 m^3	20 446	19 335	17 938	19 724	N/A
Growing stock softwood	000 m^3	2 061 416	2 074 067	2 033 347	1 672 177	N/A
Annual supply hardwood	000 m^3	11 295	10 750	10 166	10 895	N/A
Growing stock hardwood	000 m^3	1 044 433	1 006 765	839 016	761 493	N/A
Regenerating area	%	15	19	14	13	N/A
Immature area	%	20	16	30	37	N/A
Mature area	%	62	63	54	47	N/A

[a] No projections are available past the year 2100.

TABLE 14. Manitoba—Wood Supply Projections

Provincial Crown Lands

	Units	2000	2010	2050[c]	2100	2150
Annual supply softwood[a,b]	000 m^3	5 639	5 639	N/A	N/A	N/A
Growing stock softwood[d]	000 m^3	N/A	N/A	N/A	N/A	N/A
Annual supply hardwood	000 m^3	3 260	3 260	N/A	N/A	N/A
Growing stock hardwood[d]	000 m^3	N/A	N/A	N/A	N/A	N/A
Regenerating area	%	N/A	N/A	N/A	N/A	N/A
Immature area	%	N/A	N/A	N/A	N/A	N/A
Mature area	%	N/A	N/A	N/A	N/A	N/A

[a] Net merchantable annual allowable harvest reflects the latest product technology and highest level of fibre utilization.

[b] Utilization levels vary throughout the province.

[c] No projections are available past the year 2010.

[d] No growing stock information is available.

TABLE 15. Saskatchewan—Wood Supply Projections

Provincial Crown Lands[a]

	Units	2000	2010	2050	2100	2150
Annual supply softwood	000 m^3	3 049	3 053	3 020	2 879	2 835
Growing stock softwood[b]	000 m^3	N/A	N/A	N/A	N/A	N/A
Annual supply hardwood	000 m^3	2 840	2 632	2 570	2 577	2 571
Growing stock hardwood[b]	000 m^3	N/A	N/A	N/A	N/A	N/A
Regenerating area	%	19	N/A	17	16	N/A
Immature area	%	19	N/A	47	36	N/A
Mature area	%	62	N/A	36	48	N/A

[a] All figures calculated for areas held under forest management agreement only.

[b] Growing stock was not a required reporting item in the last round of forest management plans.

TABLE 16. Alberta—Wood Supply Projections

Provincial Crown Lands

	Units	2000[a]	2010[b]	2050[b]	2100[b]	2150[b]
Annual supply softwood	000 m^3	13 596	13 691	13 691	13 691	13 691
Growing stock softwood[c]	000 m^3	N/A	N/A	N/A	N/A	N/A
Annual supply hardwood	000 m^3	10 209	10 121	10 121	10 121	10 121
Growing stock hardwood[c]	000 m^3	N/A	N/A	N/A	N/A	N/A
Regenerating area	%	N/A	N/A	N/A	N/A	N/A
Immature area	%	N/A	N/A	N/A	N/A	N/A
Mature area	%	N/A	N/A	N/A	N/A	N/A

[a] Approved AAC for the period 1 April 1999 to 31 March 2000 reported to NFDP. These values have subsequently been revised to 13 592 000 m^3 softwood.

[b] Approved AAC for the period 1 April 2002 to 31 March 2003 reported to NFDP. These values have subsequently been revised to 13 807 000 m^3 softwood and 10 073 000 m^3 hardwood.

[c] No growing stock information is available.

TABLE 17. British Columbia—Wood Supply Projections

Provincial Crown Lands

	Units	2000[a]	2010[b]	2050[b]	2100[b]	2150[b]
Annual supply softwood	000 m^3	69 713	66 453	62 267	61 706	62 337
Growing stock softwood	000 m^3	4 098 814	3 853 212	3 322 851	3 180 744	3 162 228
Annual supply hardwood	000 m^3	3 132	2 986	2 798	2 773	2 801
Growing stock hardwood	000 m^3	184 168	173 133	149 303	142 917	142 085
Regenerating area	%	N/A	N/A	N/A	N/A	N/A
Immature area	%	N/A	N/A	N/A	N/A	N/A
Mature area	%	N/A	N/A	N/A	N/A	N/A

[a] The distribution of softwood/hardwood supply and growing stock was estimated using the softwood/hardwood ratio present in 2003 AAC statistics.

[b] Forecasts do not fully reflect the impact of the recent mountain pine beetle outbreak in British Columbia.

NATIONAL WOOD SUPPLY INDICATORS

This section provides a roll-up of provincial indicators. Tables and figures reported within this section include combined totals for all jurisdictions. However, some jurisdictions were unable to provide information for a particular attribute. For example, no current growing stock information is available for Alberta. Consequently, Alberta is not included in the corresponding roll-up.

CURRENT AAC AND HARVEST CONTROL

On a national basis, harvests (Table 18) fall short of allowable cut levels, especially with regard to hardwood species.

PROJECTED ANNUAL WOOD SUPPLY AND GROWING STOCK

This indicator is designed to depict future trends. Table 19 presents the projected annual wood supply and growing stock for Canada. Only those areas reported in Tables 4 to 17 are included; therefore, information on some private, federal, and territorial lands is missing from Table 19 as well as information on growing stock on provincial Crown lands in the Prairie Provinces. While the table describes a large portion of the area in Canada subject to harvesting, it should be used with caution.

TABLE 18. **Harvest Control Data—National Roll-up**

	Volume (000 m^3)
Softwood	
Periodic annual harvest[a]	127 936
Periodic annual AAC[b]	151 400
Current AAC[c]	154 848
Hardwood	
Periodic annual harvest	17 620
Periodic annual AAC	46 702
Current AAC	46 704
Total	
Periodic annual harvest	145 556
Periodic annual AAC	198 102
Current AAC	201 552

[a] Periodic annual harvest reflects the average of the combined volume actually harvested over a defined period of time in all jurisdictions.

[b] Periodic annual AAC reflects the average of the combined AAC over a defined period of time in all jurisdictions.

[c] Current AAC reflects the average of the combined current AAC in all jurisdictions.

TABLE 19. **Supply and Growing Stock—National Roll-up**

	Units	2000	2010	2050	2100	2150
Softwood						
Annual supply	000 m^3	150 629	146 768	141 673[a]	140 242[a]	121 105[a]
Growing stock	000 m^3	9 279 202	9 046 455	8 574 753	7 848 493[a]	6 143 782[a]
Hardwood						
Annual supply	000 m^3	44 727	44 301	41 884[a]	41 924[a]	31 051[a]
Growing stock	000 m^3	2 360 485	2 312 182	2 134 593	1 991 334[a]	1 229 009[a]

[a] Not reported in all years, for all jurisdictions; see Tables 4 to 17 for more information.

GLOSSARY OF TERMS

annual allowable cut (AAC)—the volume or area that may be harvested annually under existing regulations; the term "allowable annual cut" is used in British Columbia.

annual wood supply—the projected volume of wood that can be harvested per year based on assumptions about forest growth and depletion in the context of sustainable forest management; at present, this amount may be equal to annual allowable cut (AAC) on provincial Crown land; mid- to long-term projections of annual supply are not commitments to future AACs.

area-based tenure—a licence agreement based on a specified area of land under management.

area control—regulation of harvesting based on the amount of area harvested.

Crown land—land that is owned by the Crown; referred to as federal Crown land when it is owned by Canada and as provincial Crown land when owned by a province.

forecasting method—the approach used to predict future stand-level and/or forest-level values.

growing stock—the standing inventory of timber at any point in time.

long run sustained yield (LRSY)—an estimate of the maximum, non-declining volume that could be harvested if all stands were harvested at the age when mean annual increment is at a maximum.

management unit—a defined unit of land that forms the basic area for planning and management purposes.

mean annual increment—at a given age, the average net annual growth of a stand to that point.

net immature area—the portion of the net landbase supporting stands that have merchantable crops but that have not yet reached rotation age.

net landbase—the forest area on which harvesting activities can take place.

net mature area—the portion of the net landbase supporting stands that are sufficiently developed to be harvestable and are at or past rotation age.

net regenerating area—the portion of the net landbase supporting stands that are stocked but that do not yet support merchantable crops.

optimization—a forecasting method in which a description of current conditions, constraints, rules for change, and objectives are captured to identify a set of tactics that will provide an ideal balance of objectives.

planning horizon—the period of years over which forest management activities and their impacts on forest values are projected.

productive Crown land—provincially owned land capable of producing a merchantable stand within a defined period of time.

productive landbase—the portion of the total forested landbase supporting stands of trees.

rotation—the planned number of years between the stand establishment and its final cutting at a specified stage of maturity.

simulation—a forecasting method in which a description of current conditions, constraints, tactics, and rules for change are captured to predict the impact of the tactics on expected future values.

sustainability—the quality of a state or process that allows it to be maintained indefinitely; the principles of sustainability integrate three closely interlinked elements—the environment, the economy, and the social system—into a system that can be maintained in a healthy state indefinitely.

tenure—socially defined agreement held by individuals or groups, recognized by legal statutes or customary practice, regarding the "bundle of rights and duties" of ownership, holding, access, and/or use of a particular land unit or the associated resources (such as individual trees, plant species, water, and minerals).

timber flow policy—the rule(s) governing the pattern of future timber harvest levels.

timber supply analysis—an assessment of future timber supplies over long planning horizons (more than 200 years) by using timber supply models for different scenarios identified in the planning process.

timber supply model—an analytical model that simulates the harvest and growth of collections of forest stands over several decades according to specific data and management assumptions.

total landbase—the total area on which management objectives are to be implemented and evaluated.

volume-based tenure—a licence agreement based on a specified volume of wood to be harvested.

volume control—regulation of harvesting based on the amount of area harvested.

wood supply—the timber harvesting opportunities associated with a specific forest condition, management strategy, and timber flow policy.